Compressed Air Magazine

DECEMBER 1957

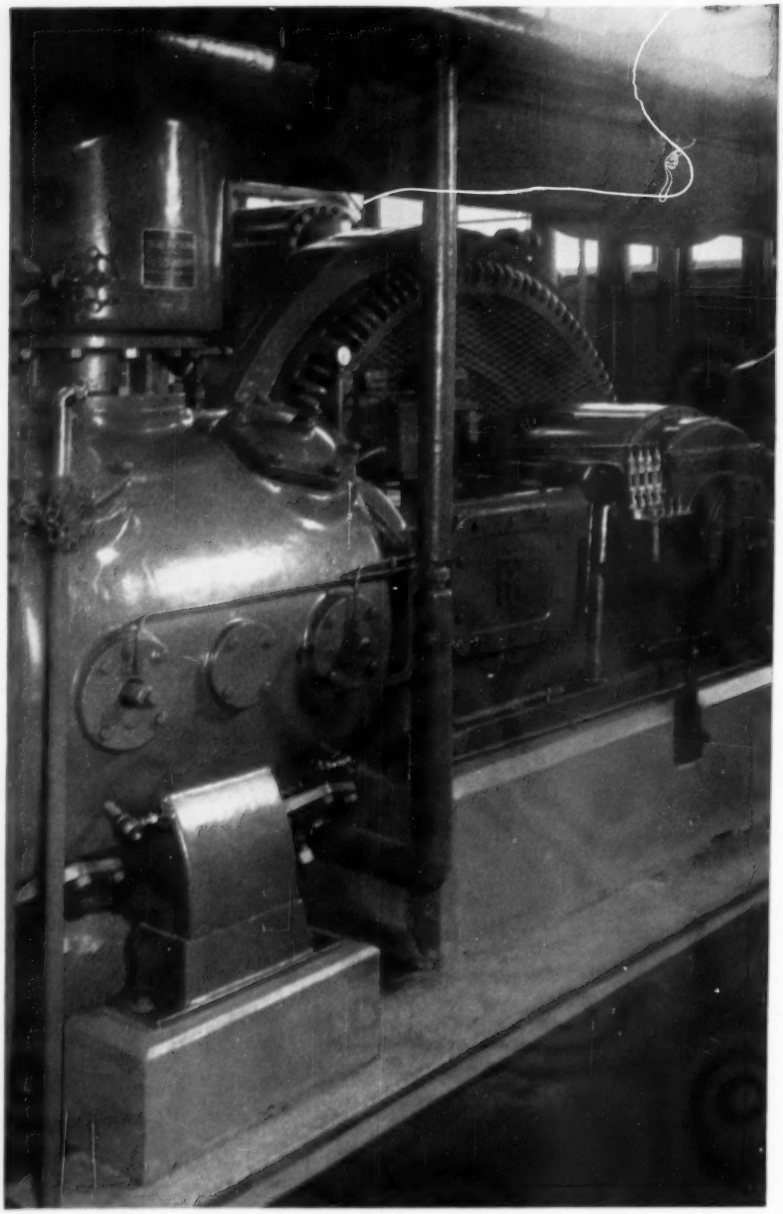
MOTHER NATURE TRIMS HER TREE

Its simple beauty rivals man's tinsel, lights and baubles

VOLUME 62 • NUMBER 12

NEW YORK • LONDON

"It keeps systems free of rust and harmful deposits"



Based on his experience with ***Texaco Regal Oil R & O*** *for all air compressor lubrication, the Plant Manager for a famous appliance manufacturer (name on request) wrote us:*

"Texaco Regal Oil R & O has done a consistently fine job for us. It keeps systems free of rust and harmful deposits — and we haven't had to replace a bearing since we started using it."

OPERATORS everywhere enjoy similar benefits. *Texaco Regal Oil R & O* is refined to premium quality, then further improved by special additives that inhibit rust and oxidation. The results are high efficiency, dependable performance, low maintenance costs.

There is a complete line of *Texaco Regal Oils R & O* to meet the requirements of all compressors and operating conditions. A Texaco Lubrication Engineer will gladly help you select the proper one. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R & O

FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

Circle 1A on reply card

KEEP IT CLEAN by Phil Tration

"On-the-job" blood purification is not a recommended use for Dollinger Staynew Filters . . . but who knows, maybe our cartoon will start a new trend.

After all, everyone in industry today is looking for new and more efficient ways of doing things. And, when it comes to new ideas in filtration, Dollinger is ready, willing, and able. Whether you want to protect machines or processes from damage caused by dust, dirt, oil, grease, or other foreign matter, Dollinger Engineers will provide a Staynew filter to do the job efficiently and economically. Chances are your filtration problem has already been solved and there is now a *standard* Staynew Filter to handle it.

STAYNEW MODEL CPH PIPE LINE FILTER

has the exclusive "double action principle." Air is first deflected to outer walls of Filters and forced downward at high speed. Water, oil, and heavier particles of rust, etc. are thus deposited in base. Mechanically cleaned air then rises to pass through filtering medium which removes lighter airborne particles. This "double action" design eliminates need for frequent cleaning.

Inexpensive, simple to install, Dollinger Pipe Line Filters pay for themselves in reduced maintenance alone. Why not talk over your filtration problems with a Dollinger engineer . . . or write for Bulletin 200 which gives engineering data on pipe line filters. Dollinger Corporation, 7 Centre Park, Rochester 3, N. Y.

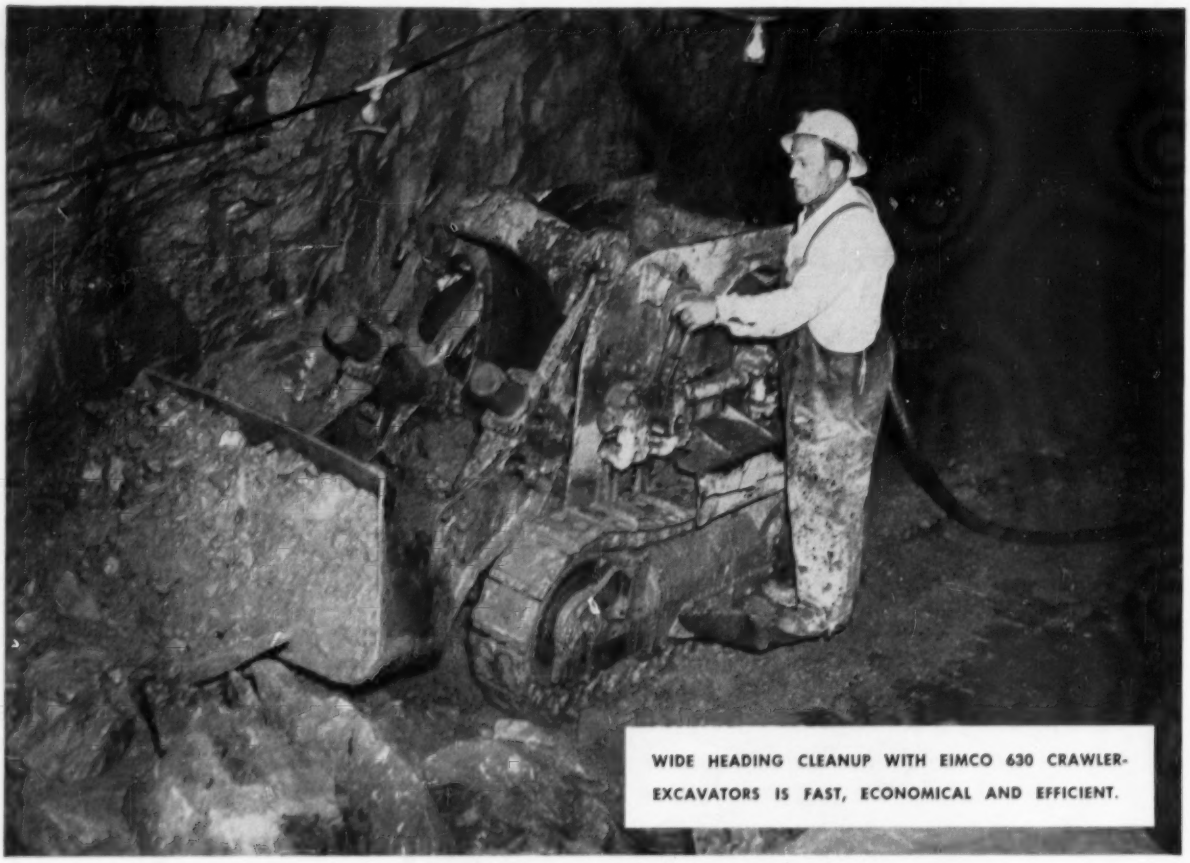
PROTECTOMOTOR

STAYNEW **DOLLINGER**

FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

Circle 2A on reply card



WIDE HEADING CLEANUP WITH EIMCO 630 CRAWLER-EXCAVATORS IS FAST, ECONOMICAL AND EFFICIENT.

REDUCE THE COST SQUEEZE WITH EIMCO 630 TRACTOR - EXCAVATORS

With the "cost squeeze" tightening . . . you can use production savings offered by the Eimco 630 Tractor-Excavator to profitable advantage.

The 630 provides you features that pay-off in more production, operator efficiency and safety. Ruggedly constructed to withstand the severest operating conditions, the 630 insures against excessive down-time and costly maintenance.

Easy, convenient controls make the Eimco respond instantly to the operator's demands. In tough digging (with independent track reversal) he can maneuver the Eimco fast and sharp — from side to side — to cram the bucket without making a new approach. He can move the loaded bucket into overhead dump position while traveling.

Bulletin L-1039 will acquaint you with more Eimco 630 details. An Eimco Engineer will provide you with reliable production information.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Pittsburgh, Pa. Seattle, Wash.
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-287

Circle 3A on reply card

Compressed Air Magazine

Founded 1896

VOLUME 62 NUMBER 12 **December 1957**

R. J. Nemmers, *Editor*
S. M. Parkhill, *Assistant Editor*
C. H. Vivian, *Contributing Editor*
D. Y. Marshall, *Europe*,
243 Upper Thames St., London, E.C. 4.
F. A. McLean, *Canada*,
New Birks Building, Montreal, Quebec

PHOTO, A. DEVANEY, INC.

ON THE COVER

THE Christmas Season is traditionally a time of tree decorating in this country and in many other countries throughout the world. Indeed, the Christmas tree industry has developed into a major business, giving seasonal employment to thousands and grossing well into the millions of dollars each year. Our cover picture shows a forest tree, beautifully and simply decorated by Mother Nature in a fashion that rivals the pretty tinsel, lights and baubles of man. With this picture we send the greetings of the Season to our readers.

FEATURE ARTICLES

Page 360 **Taming The Molly Ann**—*R. J. Nemmers*
A normally placid little stream, Molly Ann Brook in Paterson, N. J., often flooded cellars and filled streets to overflowing in the rainy season. The Board of Public Works is engaged in the last of a series of remedial steps to tame the little brook. Part of the work is to drive a two-block-long tunnel under air pressure.

364 **Unlocking The Peace River Reserves**—*Dan Eckman*
A 650-mile-long, 30 inch-diameter natural gas line has been pushed to completion in British Columbia. The line, which has unlocked the Peace River gas reserves, is described, along with some of the compressor facilities.

368 **Harnessing The Zambezi**—*R. W. Sapora*
A huge new hydroelectric power facility is taking shape on the Zambezi River in southern Africa. When completed, it will supply much-needed power for the economic growth of the Federation of Rhodesia and Nyasaland. Current operations and future construction plans are detailed.

371 **Moles Awards**
1958 honorees are Donaldson, Connolly.

372 **Modern Covered Wagons**
Many firms now send out traveling exhibits in self-contained mobile units. Several of these modern covered wagons are told of and illustrated.

373 **Imagery Afloat**—*S. M. Parkhill*
Each year, Goodyear Tire & Rubber Company becomes Santa's workshop as designs are drawn, patterns cut and balloons assembled for R. H. Macy & Company's annual Thanksgiving Day parade in New York City.

377 **Fifty-Two Years On The Line**—*Terry Henshaw*
A venerable old Rand compressor completed 52 years of active service for the same concern before being shut down for probably the last time.

382 **Stamp Of Tribute**
Canadian post office issues mining commemorative.

DEPARTMENTS

379 **Editorial**—*Materials to Order*
380 **This and That**
380 **Saving with Air Power**—*Building Pipelines with Cucumbers*
383 **Industrial Notes**
388 **Briefs**
390 **Industrial Literature**
(Adv.) 34 **Index to Advertisers**

G. W. Morrison, *Publisher*
R. W. Sapora, *Manager*

J. W. Young, *Advertising Director*
J. J. Katarba, *Business Manager*
E. G. Andrews, *Advertising Manager*

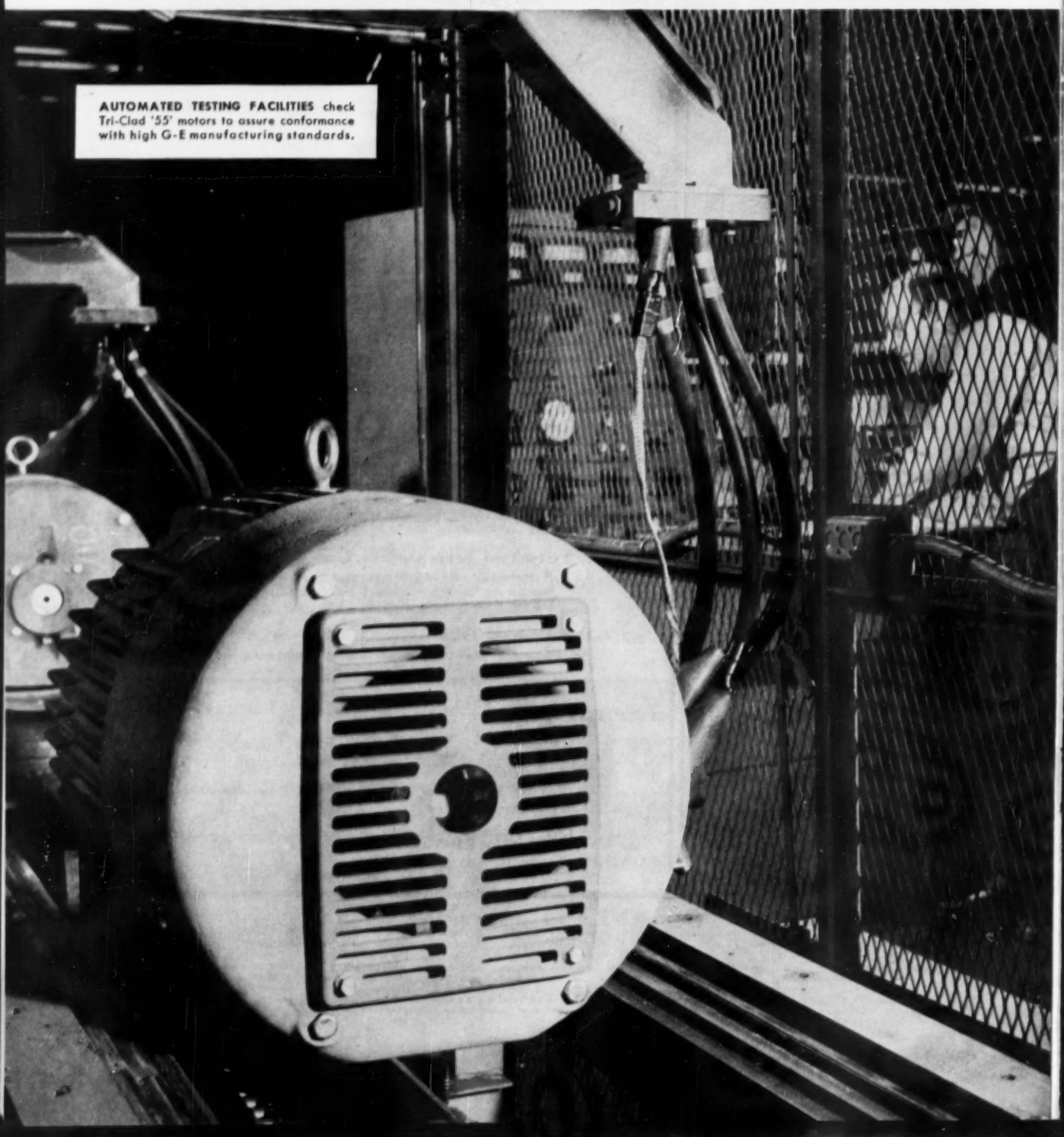
F. W. Hartman, *Circulation Director*
L. H. Geyer, *Representative*,
11 Broadway, New York 4, N.Y

BPA

EDITORIAL, ADVERTISING AND PUBLICATION OFFICES, 942 MEMORIAL PARKWAY, PHILLIPSBURG, NEW JERSEY. COPYRIGHT © 1957 BY COMPRESSED AIR MAGAZINE COMPANY. ALL RIGHTS RESERVED. ANNUAL SUBSCRIPTION, UNITED STATES AND POSSESSIONS, $3.00; FOREIGN, $3.50; SINGLE COPIES, $0.35. COMPRESSED AIR MAGAZINE IS INDEXED IN INDUSTRIAL ARTS INDEX AND IN ENGINEERING INDEX. MICROFILM VOLUMES (1946 TO DATE) AVAILABLE FROM UNIVERSITY MICROFILMS, INC. PUBLISHED MONTHLY BY COMPRESSED AIR MAGAZINE COMPANY: G. W. MORRISON, PRESIDENT; A. W. LOOMIS, VICE PRESIDENT; C. H. VIVIAN, VICE PRESIDENT; J. W. YOUNG, SECRETARY-TREASURER.

compact . . . power packed

New General Electric GREATER



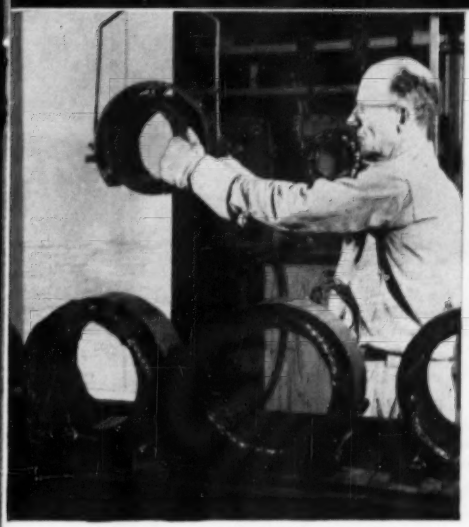
AUTOMATED TESTING FACILITIES check Tri-Clad '55' motors to assure conformance with high G-E manufacturing standards.

TRI 55 CLAD Motors Offer . . .

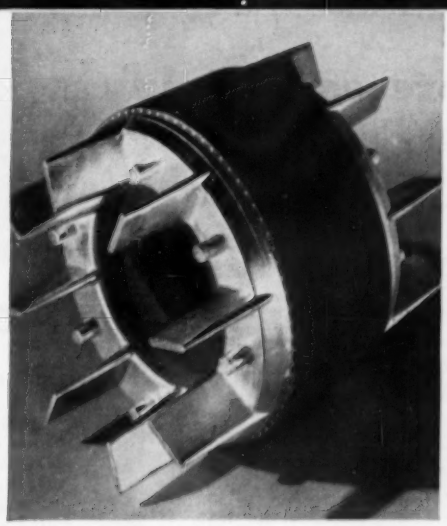
REG U.S. PAT. OFF.

RELIABILITY

NOW AVAILABLE THROUGH 125-HP



MORE EFFECTIVE INSULATION—New Mylar* polyester film slot and phase insulation gives Tri-Clad '55' stators up to 8 times more protection than conventional types. Formex® wire gives protection against heat aging.



MORE EFFICIENT ROTORS—Revolutionary new double-entrance centrifugal casting technique is utilized on rotors for new larger ratings—up through 125-hp. Solid castings result, helping to prevent localized heating.

MORE FULLY PROTECTED ENCLOSURES—Tri-Clad '55' motor frames and end-shields are cast-iron constructed to provide rigid support and corrosion resistance. Cast-in louvers help protect against contaminant entrance.

immediate shipment . . . all ratings

To cost-conscious motor users, greater equipment reliability means both immediate and long-run cost reductions. In the immediate future, it minimizes profit-robbing downtime and cuts maintenance costs; and, in the long-run, it reduces replacement costs because motors last longer.

Now, to provide increased reliability for motor users, General Electric offers a complete line of Tri-Clad '55' motors—up through 125-hp—designed to new NEMA space and weight-saving dimensions.

QUALITY CONSTRUCTION GIVES GREATER RELIABILITY—New materials and manufacturing techniques—such as those described above—are used in the production of Tri-Clad '55' motors to give added service life, with fewer breakdowns and reduced maintenance.

But, greater reliability is not the whole Tri-Clad '55' motor story. G-E engineers have also designed these new motors to provide easier installation, and reduced shipping, handling and storage costs. And, you can get *immediate* shipment—usually from warehouse stocks—of any popular Tri-Clad '55' motor rating, up through 125-hp.

FOR COMPLETE INFORMATION on the new line of Tri-Clad '55' motors, contact your nearby G-E Apparatus Sales Office or Distributor. Send in the attached coupon for free Tri-Clad '55' motor bulletins.

*Reg. DuPont Co. Trademark

Section E891-9
GENERAL ELECTRIC COMPANY
Schenectady 5, New York

Please send me the following publications:

☐ **FREE BULLETIN (GEA-6602) describes advanced features of new Tri-Clad '55' motors through 125-hp.**
☐ **FREE SLIDE RULE (GEN-148) to determine weight and space-saving benefits of new Tri-Clad '55' motors.**

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

CITY & STATE .....

Progress Is Our Most Important Product

GENERAL ELECTRIC

Fast...

Positive!

Quarter-Turn Control

for Compressed Air Lines

GRINNELL-SAUNDERS DIAPHRAGM VALVES

Simple operating principle A double-acting cam lowers the valve stem smoothly and with relatively little effort for fast, positive closure. Raising the stem to open the valve, in the 2-inch size, is accomplished by this same cam. In all the smaller sizes, return spring action replaces cam action in opening the valves.

Eliminates Compressed Air Leaks Designed specifically for compressed air lines, the Grinnell-Saunders Diaphragm Valves give positive leakproof closure. A flexible diaphragm, seating on metal, assures this perfect seal. At the same time, because working parts are wholly isolated, no packing glands are necessary, and stem leaks are impossible.

Variety of Applications In the smaller sizes, the quarter-turn, lever-operated Grinnell-Saunders Diaphragm Valve is ideal for air-operated tools, presses, clamps, molds, or wherever fast control is requisite. In the larger sizes, it supplies quick control of air agitators, or large headers at compressors where speed may be a safety factor.

Lower Maintenance is a further big advantage you get with Grinnell-Saunders Valves. No refacing or reseating is required. No packing glands to demand attention. And diaphragm replacement can be made simply, without removing valve body from the line.

For further details, write for Grinnell-Saunders Diaphragm Valve Catalog.

SIZES: ½ to 2-inch

CHOICE OF MATERIALS

Bodies — iron; cast steel; stainless steel; Durimet 20; Hastelloy A, B, C; bronze; Monel; aluminum; PVC (polyvinyl chloride); Saran

Body linings — hard rubber; soft rubber; neoprene; glass; lead; plastics; Heresite; Lithcote

Diaphragms — soft natural rubber; natural rubber; white synthetic rubber; neoprene; reinforced neoprene; butyl; Hycar; Teflon; Kel-F; PVC (polyvinyl chloride); polyethylene

Bonnets — iron; stainless steel; bronze; other materials on special order

CHOICE OF BODIES

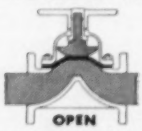
Straight bodies — screwed; flanged; socket weld; butt weld; socket (solder); sanitary threads; hose ends; Victaulic

Angle bodies — screwed; flanged; socket weld

OTHER BONNETS: ¼ to 18-inch

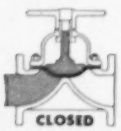
Handwheel (non-indicating stem, indicating stem) ¼ to 18-inch; sliding stem (for a wide selection of power operated topworks), ½ to 12-inch.

SIMPLICITY OF OPERATION



OPEN

Diaphragm lifts high for streamline flow in either direction



CLOSED

Diaphragm presses tightly against the valve weir for air-tight closure

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Circle 5A on reply card

new

from

Ingersoll-Rand

5-706 11 Broadway, New York 4, N. Y.

It's the sensational

VACUJET ROOF BOLTING DUSTLESS STOPER

with built-in JET SUCTION
and PRESSURE DISCHARGE

In the new RP38E VACUJET dustless stoper, Ingersoll-Rand has perfected the first practical solution to the problem of dust control for roof bolting and other up-hole drilling operations. It's the *only* stoper that offers you all these important advantages.

Strong Suction Power — vacuum-producing jet ejector built into drill backhead. Can even drill horizontal holes!

Dust Discharged Under Pressure — to a distance of up to 25 ft from drill. Uses ordinary air hose.

Low-Cost Dust Collector — a simple filter and receptacle is all that's required. Even a canvas bag will do.

Quieter Operation — no unnecessary ear-splitting whine or howl in dust collection.

Highest Drilling Speed — because stronger vacuum and larger dust ports assure non-clogging operation.

Lower Bit, Rod and Shop Costs — tapered bit and rod connections eliminate need for furnaces, threading and forging equipment.

For the complete story on this revolutionary new VACUJET stoper, call your I-R man or send today for Bulletin No. 4195.

COMPRESSORS • CARSETS BITS • ALLOY RODS • HYDRA-BOOM JUMBOS HOSE • JACKDRILLS • IMPACTOOLS

Circle 6A on reply card

No clutch to wear, slip or adjust. Operation reversible. Nickel alloy steels provide the toughness, hardness and high strength/weight ratios needed in vital parts of two new Torsion-Bar Torque Control Impactools. One for heavy bolted steel construction . . . shown here . . . has adjustable torque range up to 550 foot pounds. The other, to 90 foot pounds. Produced by Ingersoll-Rand Co., Air and Electric Tool Division, New York 4, N. Y.

Nickel alloy steels toughen new tool to run nuts, full speed, to preset torque

No pressure regulator, yet this revolutionary new Impactool speeds the run-down of nuts to a desired tightness, and then automatically shuts off. You can use it at full power and speed.

Nickel steel stands gaff

Heart of the tool . . . shown in the drawing . . . is the torsion-bar torque control. This vital mechanism uses nickel alloy steels to withstand impact and stresses from blows hammered at a rate reaching up to 2400 per minute.

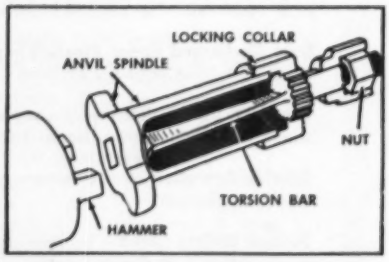
Ingersoll-Rand engineers use nickel steels to obtain hard, wear-resisting, non-spalling surfaces supported by cores with ample toughness to resist shocks and overloads. As in anvil lugs and locking collar.

For torsion bars, the engineers use a grade of nickel alloy steel that combines toughness with high yield strength.

You can improve specific *mechanical* properties in many a metal by adding nickel . . . alone or in combination with other alloy elements. In addition, the nickel content helps to improve *fabricating* properties.

• • •

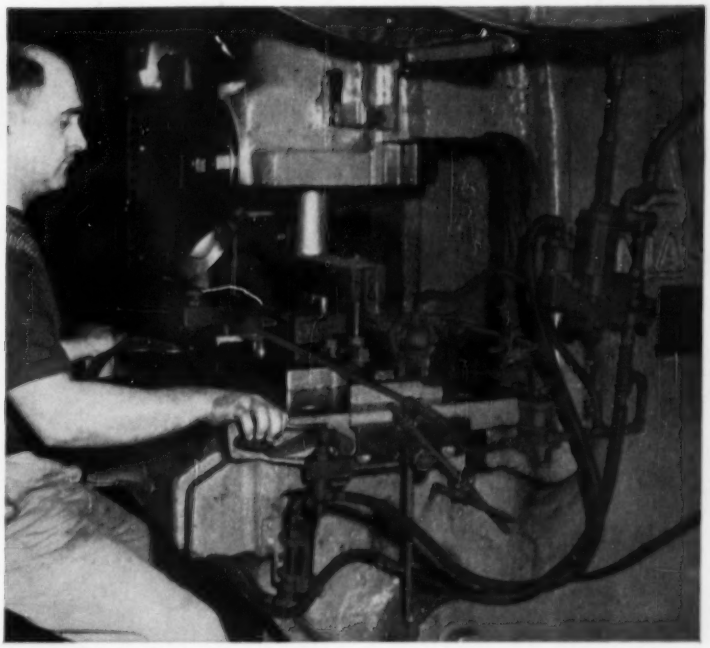
Whatever your product, when you face questions about metal let us give you the benefit of our wide practical experience. Write for "List A" of available publications. It includes a simple form that makes it easy for you to outline your problem.



Anvil lugs, spindle, torsion bar and locking collar of Impactool torque control mechanism are nickel alloy steels notable for toughness. When nut running resistance equals preset stress, torsion-bar snaps back, causing hammer to rebound and trigger shutoff valve.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

For automation and safety... Schrader Packaged Air Sets upgrade machine tools

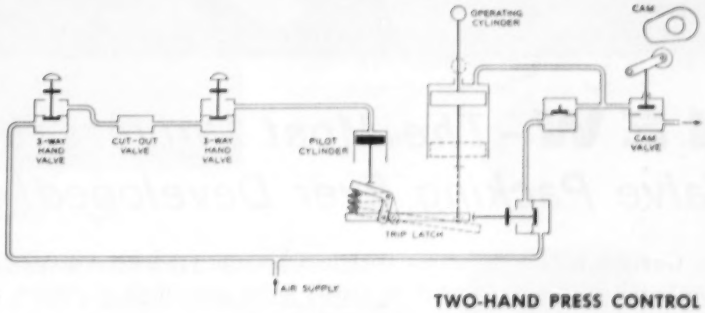


Punch press will not operate unless both hand valves are pressed at once. The press cycle cannot be repeated until the hand valves are released and the pilot cylinder is vented to atmosphere by the cam valve. A cutout valve prevents continuous press operation with one hand valve tied down. Air ejection is accomplished by cam action that actuates air column. Safety first with a Schrader Packaged Air Set.

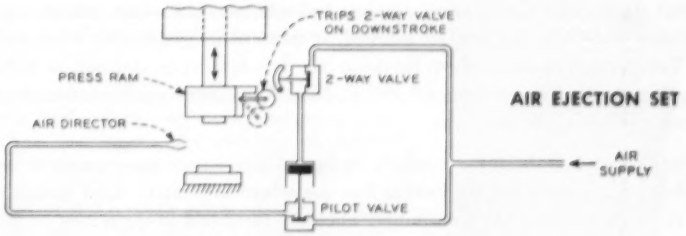
Schrader Packaged Air Sets eliminate hazards to press control and ejection systems operators like the man at right. They force him to keep his fingers free because the hands that feed the press or tool must also operate it. And both hands *must be used at once*—can't stray into danger. Fast, clean air ejection—moves the part off—automatically!

At the same time, performing both stamping and ejecting, finger and toe-tip action is light as air—keeps this operator fresh and efficient—steps up production! You can have the same!

Use these versatile pneumatic machine controls and air ejection sets not only on power presses, but shears, brakes, friction clutches, and any machine using a mechanical clutch. They are "off-the-shelf" items—ready to use! Write Schrader for details. Our distributors are located close by. Your most special requirements will in all likelihood be no problem at all with convenient, low-maintenance Schrader packaged control sets.



TWO-HAND PRESS CONTROL



AIR EJECTION SET

Schrader
a division of SCOVILL

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
473 Vanderbilt Avenue, Brooklyn 38, N. Y.
QUALITY AIR CONTROL PRODUCTS

A. SCHRADER'S SON • Division of Scovill Mfg. Co., Inc.
478 Vanderbilt Avenue, Brooklyn 38, N. Y.

Please send latest informative booklets which show Schrader's complete line of products.

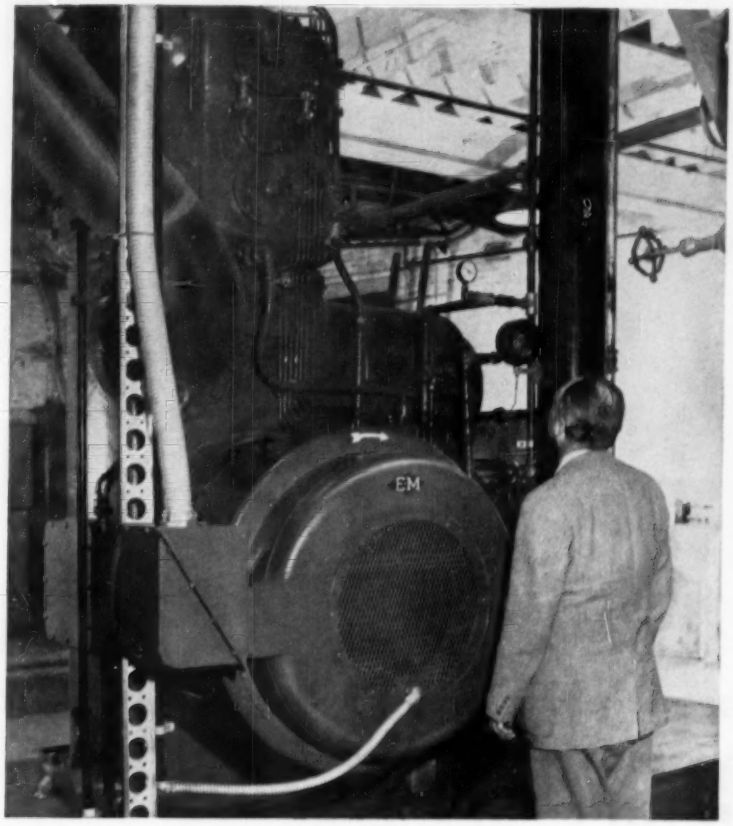
Name _____ **Title** _____

Company _____

Address _____

Circle 7A on reply card

What control would you specify for a flange-mounted synchronous motor air compressor drive?



Paktrol efficiently controls this E-M 200 hp, 514 rpm, 1.0 PF, 440-volt Flange-Mounted Synchronous Motor at The Eberhard Company.

Here's why Eberhard chose the NEW **E-M** PAKTROL CONTROL

The Eberhard Company of Cleveland, Ohio, a division of Eastern Malleable Iron Company, selected an E-M Flange-Mounted Unity Power Factor Synchronous Motor to drive an air compressor in their plant. The compressor is unloaded at start and operates at standard load and speed.

Such characteristics meant that a simplified control could be used. A control having meters, field rheostat and a separate motor-generator set for field excitation was unnecessary.

Careful comparison by Eberhard of the new simplified E-M Paktrol Control with other type controls resulted in it being chosen for the features given below.

Features and Advantages of NEW PAKTROL CONTROL

1 Lower Cost — Wherever Paktrol can be used costs are saved two ways. Its built-in selenium rectifier lowers both initial and installation costs as compared to those of a separate synchronous motor control and motor-generator set.

2 Simple Operation — Start-stop pushbutton magnetic full-voltage operation with "conscious" control by the E-M developed Polarized Field Frequency Relay system.

3 Full Protection for Motor and Control — Relays protect against overloads, overcurrents, abnormally low line voltage, single-phase operation, or out-of-step operation. Fuses protect rectifier and transformer.

4 Minimum Maintenance — Static rectifier for d-c field excitation eliminates maintenance of brushes, commutator, and bearings of conventional rotating exciter.

Paktrol is available for use with unity power factor flange-mounted synchronous motors driving air compressors in ratings of approximately 75 thru 200 hp in applicable speeds of 720, 600, or 514 rpm.

Let your nearest E-M sales engineer show you how to get the best performance from your air compressor flange-mounted synchronous motor drive. Write the factory for E-M Paktrol Control Bulletin No. 220.

E-M

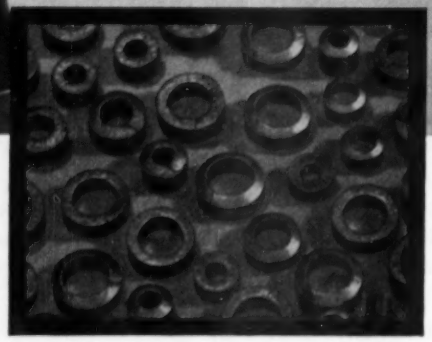
3100—TPA—2184

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

***Specialists in making motors do* EXACTLY WHAT YOU WANT THEM TO**

← Circle 8A on reply card
Circle 9A on reply card

NEW – *The Most Universal Valve Packing Ever Developed!*



New Garlock 5022 is the nearest thing to a universal valve stem packing. Its many advantages far outweigh its slightly higher cost. Made of asbestos and TEFLON* pressed into a dense die formed ring, the new packing stands up against steam, water, mild acids, alkalies, and solvents. It is clean, cannot contaminate or discolor the product handled. It contains no graphite or lubricant; the TEFLON acts as an excellent lubricant yet does not exude, dry out, or burn out. Withstands temperatures to 500° F. Ideal for original equipment such as valves, faucets, appliances, etc.

Garlock 5022 and the other Garlock Molded Valve Rings listed at right are available specifically for production line use where accurately sized packings are required for high speed assembly. They are furnished in quantities of 500 and over, in many standard sizes or to your exact specifications.

Molded Valve Rings are another important part of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for every need. The *only* complete line. That's why you get unbiased recommendations from your Garlock representative. Call him or write for Valve Ring Data.

OTHER GARLOCK VALVE RINGS

Garlock 160 Rings for use against steam at temperatures to 600° F.

Garlock 161 Rings for use against cold water and alcohol.

Garlock 162 Rings for use against cold oil, gasoline, benzol, chlorinated solvents, etc.

Garlock 163 Rings for use against high and low pressure steam, water, alcohol and some aqueous solutions.

Garlock 166 Rings for use against steam or gases to 600° F. hot or cold water, oils and solvents.

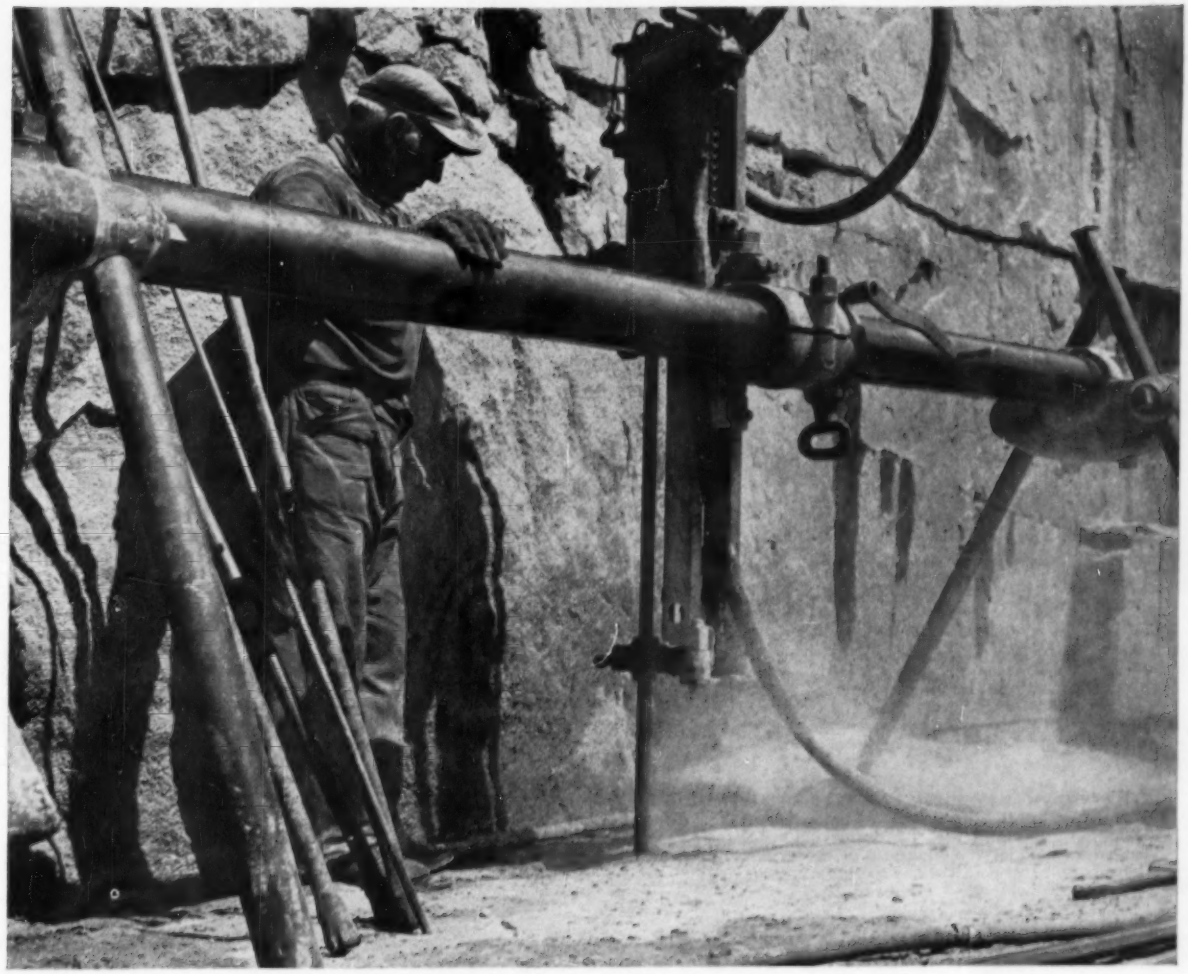
THE GARLOCK PACKING COMPANY, Palmyra, New York

*DuPont Company Trade Mark

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U. S. and Canada.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints, Fluorocarbon Products



On an island off Jonesport, Maine, the granite quarry operated by Moose-A-Bec Quarries Co., Inc., uses Bethlehem Hollow in their drills mounted on quarry bars. *Drill steel supplier:* Bicknell Mfg. Co., Rockland, Me.

Quarrying Granite Off Coast of Maine

This picture, showing Bethlehem Hollow Drill Steel biting into granite, was taken at a quarry operated by Moose-A-Bec Quarries Co., Inc., on Hardwood Island, at Jonesport, Me.

At this quarry, which is one of the country's few remaining offshore granite workings, rectangular blocks of medium hard, abrasive stone are cut from a solid mass in single units weighing about 15 tons, for use in the building industry. The drilling is accomplished with jackhammers and drifters equipped with Bethlehem Hollow Drill Steel exclusively, in rounds, hexagons and quarter octagons, and fitted with carbide-insert bits. The quarry management sums up the performance of the drill steel in one word: "Excellent."

Bethlehem Hollow Drill Steel gives a good account of itself in all kinds of rock drilling jobs because it is rolled from fatigue-resistant steel, and has a hole of uniform diameter, centrally located in the bar. Bethlehem Hollow also has a wide quenching range. What's more, it is easy steel to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and sturdy shanks.

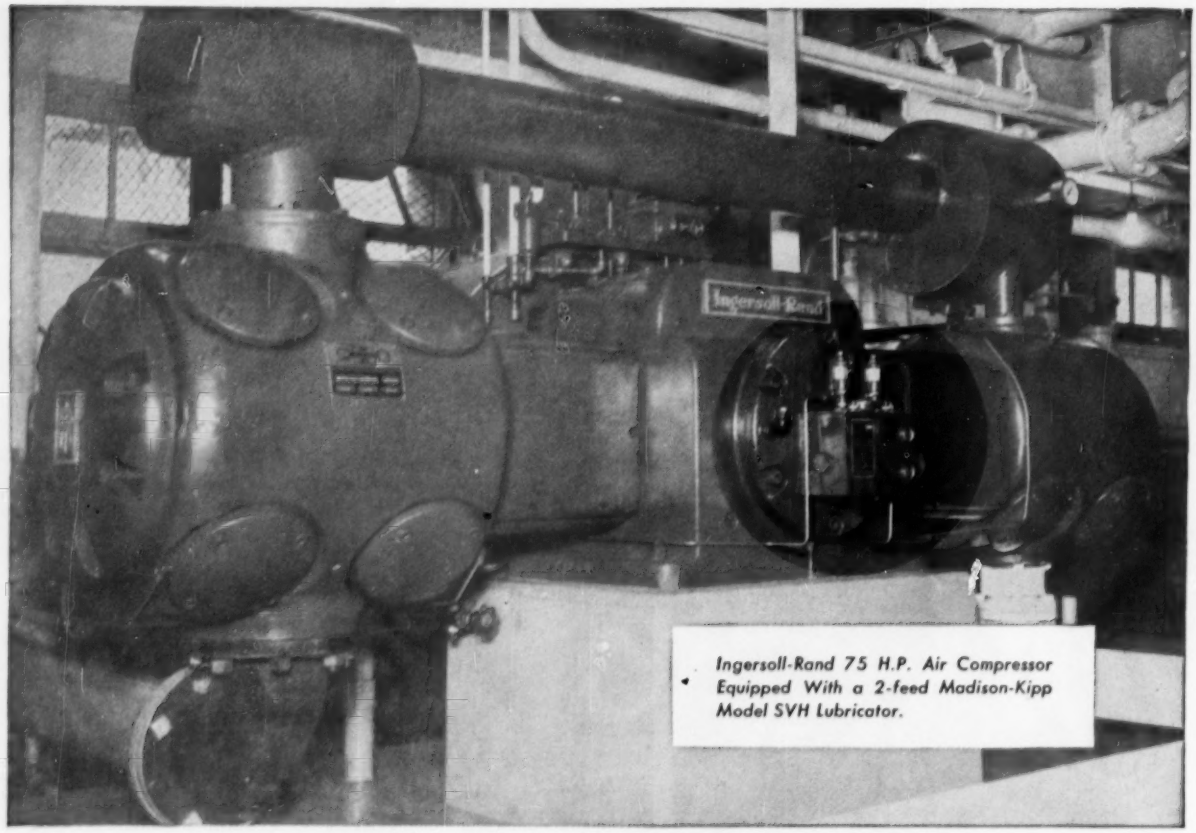
Bethlehem Hollow is furnished in Carbon and Ultra-Alloy grades in regular lengths of from 18 to 27 ft. Longer lengths can also be furnished. Bethlehem Hollow is hard-working drill steel—good steel to keep in mind for any rock drilling job.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL



Ingersoll-Rand 75 H.P. Air Compressor Equipped With a 2-feed Madison-Kipp Model SVH Lubricator.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

Fresh Oil ... by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
202 WAUBESA STREET • MADISON 10, WIS., U.S.A.

- Skilled in Die Casting Mechanics
- Experienced in Lubrication Engineering
- Originators of Really High Speed Air Tools

Circle 10A on reply card

LOCATION MAP

Previously completed stages of the Hillcrest Flood Relief Program are indicated on this map as broken lines. The sections under discussion are shown as solid lines. "X" marks the compressor house, change shacks and field office. The access shaft for the tunnel is at the corner of Rossiter and Union avenues.

TAMING THE MOLLY ANN

1900-foot-long tunnel will Drain overflow waters From Molly Ann Brook

R. J. Nemmers

THE CITY of Paterson, N.J., for the most part, is contained within a loop formed by the Passaic River. On the west edge, on the other side of the river however, is the city's Second Ward, a residential area known as Hillcrest. A topographical map of the ward shows that it is hemmed in by a medium range of hills on three sides and on the fourth, of course, by the Passaic. The surrounding hills and the flats that make up the section are drained by Molly Ann Brook, a pleasantly meandering stream most of the time.

During rainy spells, however, the Molly Ann is filled to overflowing with the runoff from the entire area. Due to the fact that at many places in the valley her bed has been restricted and narrowed by the many buildings of a thriving city, the Molly Ann can't hold all of the water directed her way. As a result, basements in the district were often flooded and streets ran gutter-high with the overflow.

As is shown on the accompanying map, the Molly Ann flows roughly southward across the ward, being directed through an underground flue that begins in the block bounded by Rossiter and Sherwood avenues. It reappears a block later and, after passing under several bridges, feeds into the main river about a mile above Passaic Falls.

First stages of the relief plans are shown as broken lines on the map. Various-sized storm sewers and outlet structures were cut under the lower part of the city to relieve part of the problem. The final stages of the efforts of the Board of Public Works of the City of Paterson to tame the Molly Ann will result in the works shown in solid lines on the location map. These consist of a bypass culvert to relieve the restriction of the flue previously described; a 90-inch-diameter intercepter sewer from Rossiter Avenue, along Crosby Avenue, to join with an existing 90-inch line; an open-cut line from a junction structure at the corner of Rossiter and Crosby avenues west to intercept the Molly Ann; a relief spillway; and from the Rossiter junction structure, under Rossiter Avenue, a 9-foot-diameter main discharge tunnel to join with existing relief drains that discharge into the Passaic both above and below Passaic Falls. The crest of the relief spillway lies well above normal water level in the brook so that, except for time of flood, no water will be diverted from the stream.

The idea of the over-all project, of course, is to help the Molly Ann get rid of the excess water. Certain portions of the project—the Crosby Avenue intercepter, for example—tie into the storm sewer system to provide outlets for that water. The bypass channel relieves the restriction in the bed of the Molly Ann and thus helps to utilize the available capacity of the stream to the utmost. The relief spillway and the Rossiter Avenue tunnel are designed to carry off the water that can't be handled by the brook.

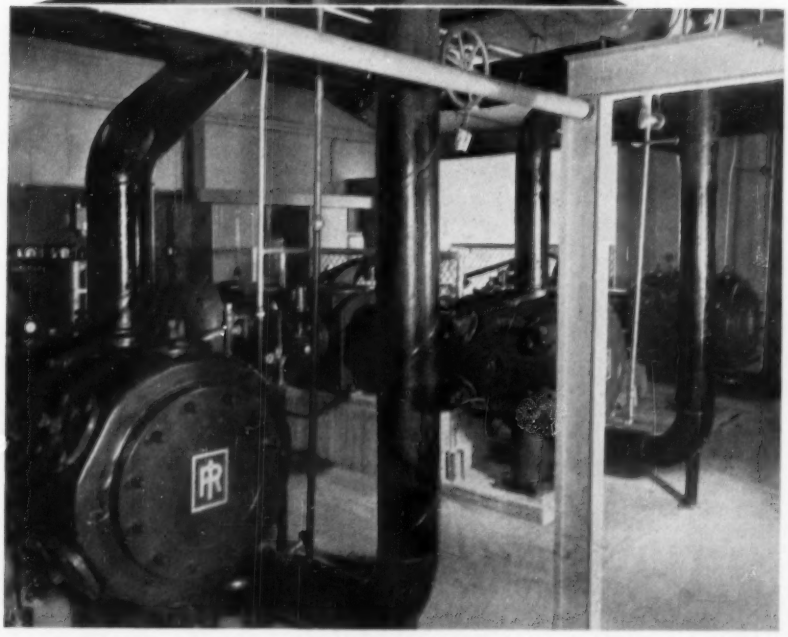
The contract for the final stages of the relief work was awarded to a joint venture of LaFera Contracting Company, Miehle-Salvatore and Tunnel Constructors, Inc. The LaFera firm is the prime contractor on the job. James Crawford is general superintendent and project engineer; Larry Deming, the engineer; and Bill Jonas, Dennis Haggerty and Dan Cannon are tunnel superintendents. Dr. Masami Yamaguchi is the resident physician for the contractors, caring for the sandhogs and supervising their work hours in the pressure tunnel. William DeMarzo is the resident engineer for the consultants, Bogert & Childs Engineering Associates. Anthony Cammarata is LaFera's engineer in charge of the open-cut work on the culvert and spillway. Harry L. Schoen is Chairman of the Board of Public Works.

CONTROL AIR SUPPLY

Also installed at the contractor's Sherwood Avenue air plant is this Ingersoll-Rand Type 30 single-stage compressor. Powered by a 10-hp Diehl motor, the unit supplies control and utility air and is tied into the supply for the medical lock.

HIGH AIR SOURCE

Air for clay spades and rock drills in the tunnel is supplied by three 600-cfm portable compressors and, as required, an additional 315-cfm or another 600-cfm unit. All discharge to a common header from whence air is conveyed to the tunnel. The machine shown above is the 315-cfm unit, an Ingersoll-Rand Gyro-Flo (rotary) compressor. It is positioned just outside the building in which the other compressors are housed.



LOW AIR SUPPLY

The machines used to supply air for pressurizing the tunnel were erected in a manner more typical of permanent industrial installations than of temporary services such as construction jobs, as is shown in this illustration. The contractor determined that the slight additional cost of a well-laid-out plant was more than compensated for by the absence of maintenance worries and virtually 100 percent compressor availability. The four machines, Ingersoll-Rand ESH-1 units, are served by Dollinger Staynew intake filters and I-R pipeline (PL) aftercoolers. Design output (actual delivery) of the 17-inch bore, 11-inch stroke compressors is 983 cfm at 35 psi and 400 rpm.

The Second Ward is founded largely on a layer of quicksand and mixed rock boulders overlying the country rock of the region which is a Passaic sandstone. The quicksand-mixed boulder layer ranges from 40 to 60 feet in thickness; it is on this saturated ground that the control structures are being built; and through it, that the Rossiter Avenue tunnel is being driven. Tunnel men call this type of ground "alive." When digging into it, or trying to tunnel through it, the ground shifts—indeed, it is almost fluid. As an example the builders of the flood relief structures point to the Rossiter Avenue junction box. Heavy sheet metal piling was driven into the ground around the work site and H-piles added to reinforce it. Then, as the open excavation continued, the piling was heavily crossbraced from within. Despite all this, however, the enormous pressure of the shifting ground warped and bent some of the piles, springing them out of alignment. Some 500 cubic yards of reinforced concrete were placed in the junction structure and relief spillway to combat ground conditions. An additional 300 cubic yards were required for the bypass structure.

Naturally—and as we have indicated—tunnel work in this type of ground is being done under air pressure. The access shaft for the tunnel was sunk at the corner of Rossiter and Union avenues, roughly halfway between the ends of

the tunnel. That portion of Rossiter Avenue, of course, has been closed for the duration of the job. The air plant is located on Sherwood Street (where the X appears on the map) and both high- and low-air are piped from that point to the access shaft. The low-air plant consists of four Ingersoll-Rand ESH single-stage double-acting compressors. With 17x11-inch cylinders the machines turn out air at pressures ranging up to about 25 to 31 psi. Normal pressure in the tunnel averages about 15 psi above atmospheric. The machines are automatically controlled, loading and unloading as well as starting and stopping in accordance with tunnel requirements.

Originally the low-air compressor installation had been designed for 100-percent stand-by capacity. In other words, two machines were to have carried the load, with the remainder on stand-by. It is an indication of the looseness of the ground therefore, that all of the machines have usually been in service, operating 24 hours a day, 7 days a week during that period when both headings were under air pressure. Indeed, it even became necessary several times to bleed additional air from the high-air supply into the header to maintain pressure. No real blowouts have occurred; the ground just seems to soak up the air. In addition, it frequently has found its way into the sanitary sewer which runs above it and which had been previously cracked by the shifting soil. The sanitary sewers thus were plugged by sand carried into them, but the contractor made arrangements for the evacuation of the families whose homes were thereby affected and saw to it that they were inconvenienced as little as possible.

The ESH machines (rated at 983-cfm actual delivery at 35-psi pressure) discharge through Ingersoll-Rand PL (pipeline) aftercoolers to storage tanks. Lines leading from the tanks then carry the air to a valve house near the access shaft where an operator is in attendance at all times to control the tunnel pressure. Emergency stand-by lines also are in place so that there is no danger of losing the air supply to the workings. In addition two separate power lines serve the compressor house. Each of the machines is driven by an Elliott Company 125-hp induction motor through seven Gates Rubber Company V-belts, the compressors operating at 400 rpm and the motors, at 1180 rpm.

The high-air plant consists of three 600-cfm portable compressors supplemented as required by either a 315- or another 600-cfm unit. The machines discharge to a common header from whence air is piped to the access shaft.

The Rossiter Avenue tunnel itself is driven to a diameter of 11 feet. No shield is in use, Truscon ¼ by 16-inch steel liner plates being placed as the heading is advanced. The tunnel then is lined to a finished diameter of 9 feet using the Pumpcrete method and a collapsible form. Spoil is loosened with Ingersoll-Rand No. 73 clay spades and hand-mucked into an I-R air-motor-powered conveyor dumping into 1-yard-capacity mine cars. The latter are hauled to the access shaft by a storage-battery-powered locomotive and hoisted to the surface by a truck-mounted crane. In sections where rock outcroppings come into the tunnel line, five Ingersoll-Rand JR-38A Jackleg drills are utilized for drilling blast holes. In solid rock sections, jumbo-mounted wagon drills (four Ingersoll-Rand DA30 machines) are in service.

The access shaft was put down only a few feet before it had to be put under air pressure, and a vertical man and material lock was installed. When the shaft was bottomed at approximately 45 feet below the street level, and the headings turned, horizontal locks were set into place. The access shaft was then lined and internally braced, and the first lock removed. The tunnel slopes upward on a grade of 1.16 from its lower end to the Rossiter Avenue junction structure. The lower end is thus approximately 60 feet below street level, the upper end, about 30 feet.

The contract for the work, including the tunnel, open-cut sections and spillway was awarded on a bid price of $2,275,000. Work got under way in March and the tunnel headings were turned in April. The job is to be completed next month.

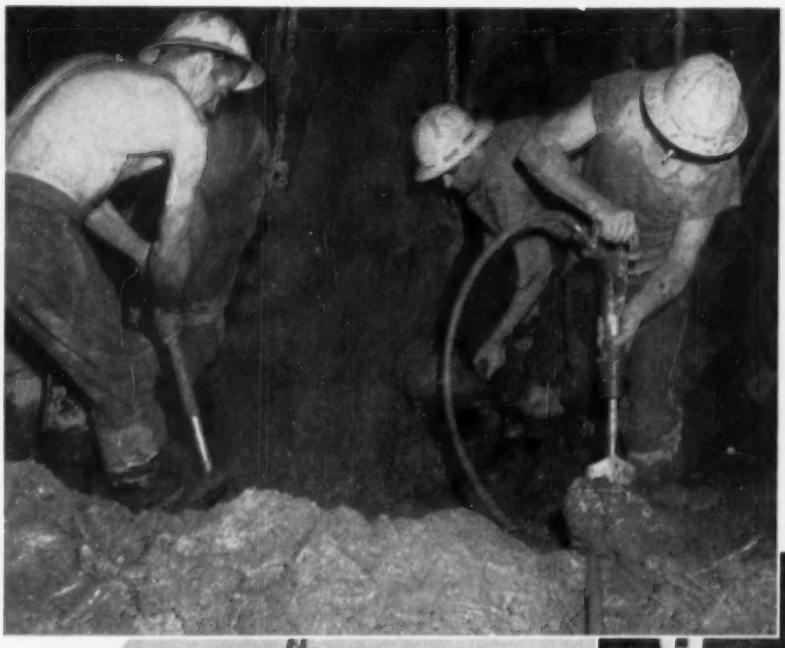
Work on the tunnel has progressed around the clock, 6 days a week. The sandhog crews swing shifts after 3 hours underground. A medical lock, a resident physician and a completely equipped hospital are provided for their protection. Stringent safety rules have been enforced during the job, and there is a commendable accident rate. In the heading, a 6-man crew works: two miners, two muckers and two men handling chores around the conveyor and switching cars. A locomotive operator and an eighth man, on duty at the locks,

"HEADFRAME"

The access shaft and appurtenant structures sprawl across Rossiter Avenue at its junction with Union Avenue. Looming from behind the structure is the boom of a truck-mounted crane used to haul muck from the shaft. The compressor house, field office, change shacks, etc., are located about a block north and a block west of the shaft.

ROCK WORK

Occasional outcroppings of rock into the tunnel are drilled by Ingersoll-Rand JR38-A Jackleg drills, two of which are shown at the right. Crucible EEEE alloy steel is used along with Carset (tungsten carbide insert) bits of various sizes.

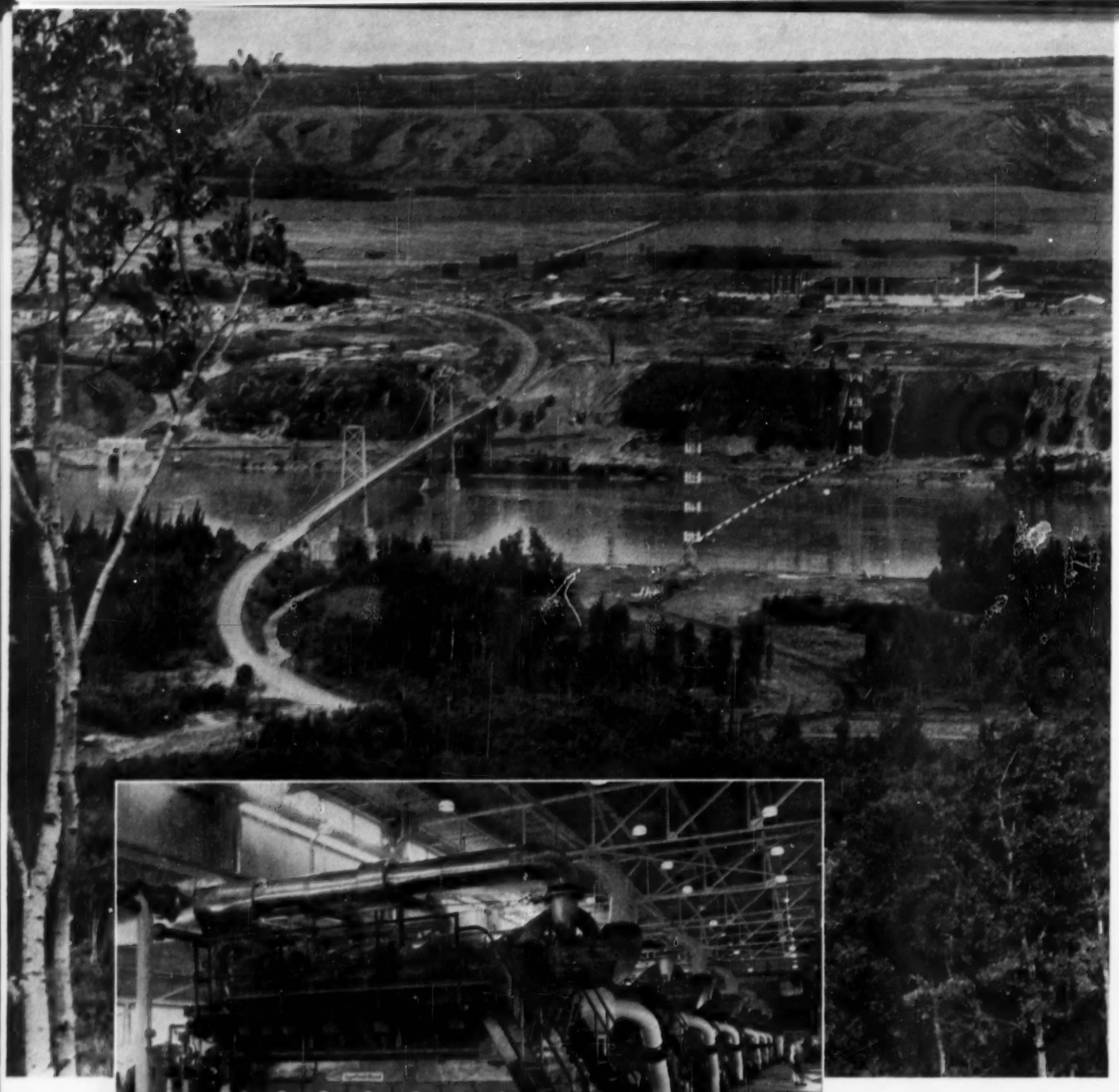


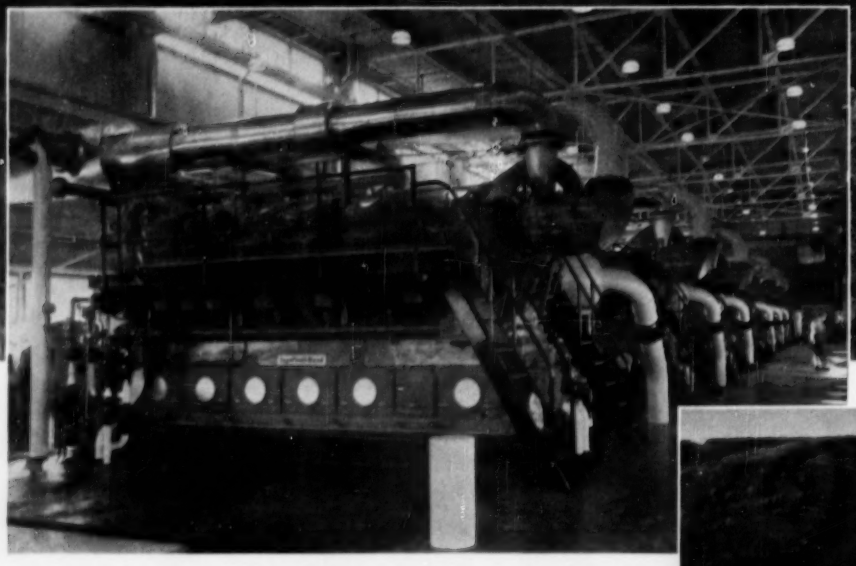
also are in the tunnel. A tunnel superintendent completes the underground force.

Above ground, a crew handles muck hoisting and dumping at the shaft, another group drives a fleet of trucks hauling the muck to a spoil dump, a man is on duty in the compressor house and, as we have indicated, another is in the valve control house.

SLIPPERY FOOTING

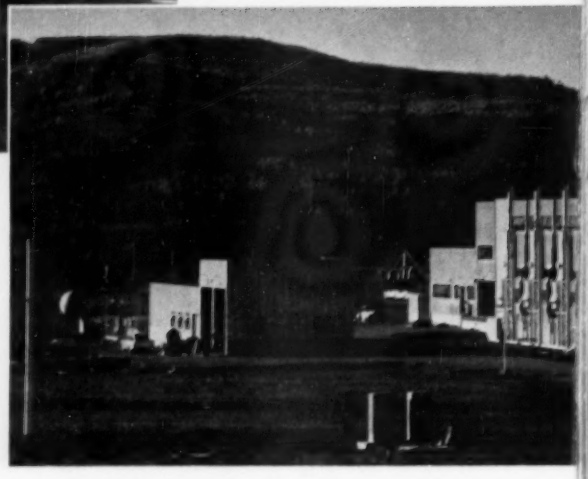
The wetness and looseness of the soil through which the tunnel is being driven is plainly shown in these illustrations. Ingersoll-Rand Size 73 clay spades are at work loosening the soil, which is then hand mucked into the air-motor-powered conveyor shown at the left. The chains framing the sandhog in the other picture support the conveyor which is suspended from a monorail along the roof line.





COMPRESSORS

At Station 1, six reciprocating compressors (Ingersoll-Rand 412 KVS units) handle the peak 660 million-cubic-foot-per-day load. Having a total of twelve power cylinders, each machine has four compressor cylinders. The machines are designed to discharge at from 750 to 950 psig, taking suction in the range from 300 to 850 psig.



STATION 1

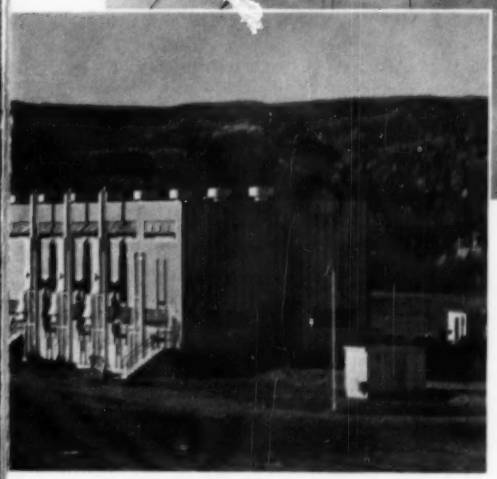
An exterior view is shown here of Station 1 at Taylor, B. C. American Air Filter engine filters are shown at the side of the main compressor house. In the background are the hills surrounding the Peace River Valley.

OVERLOOKING TAYLOR FLATS
In the right center of this illustration can be seen what is said to be the British Commonwealth's longest suspension span (it is painted in alternating stripes). The bridge is 1675 feet long between towers and carries not only the 30-inch main Westcoast line, but a 26-inch one that brings gas from Albertan fields to Station 1 as well. Immediately above the bridge can be seen the compressor station and, in the background the plant for separating the liquid hydrocarbons and sulphur. A refinery is also to be erected close by.

UNLOCKING THE PEACE RIVER RESERVES

650-mile-long, 30-inch-diameter natural gas link Brings fuel to British Columbia and Pacific Northwest of United States

DAN ECKMAN



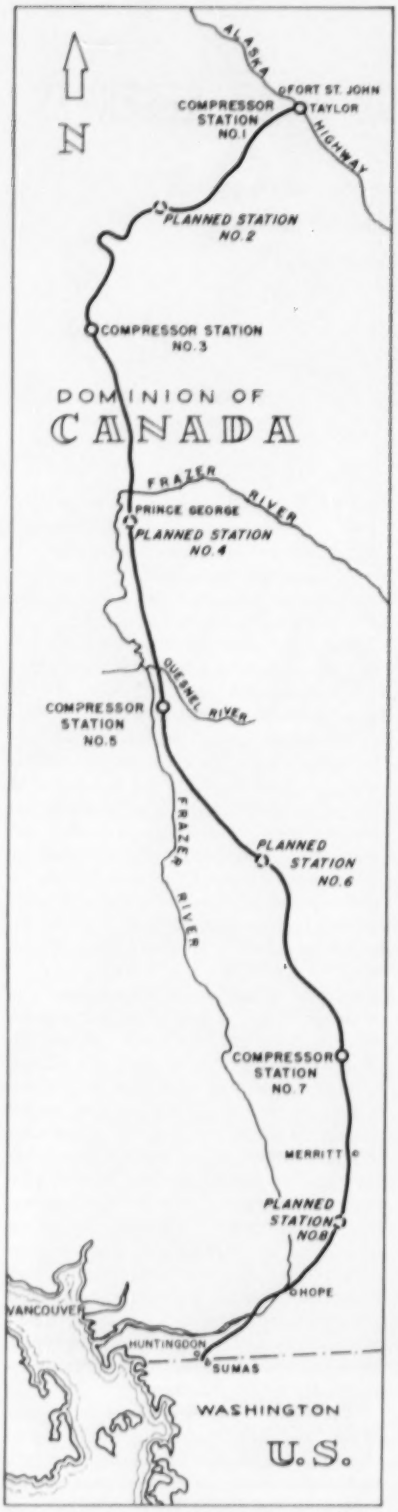
HIGH OVER THE FRASER
Silhouetted against a leaden Canadian sky, construction workers are shown making preparations for placement of the final link in the crossing of the Fraser River near Flood, B. C. Although the terrain was generally rugged, even precipitous in spots, pipeliners encountered few problems that had not already been solved in similar situations in the United States.

EARLY last August, in Pine Pass in northeastern British Columbia, a shower of sparks from a welder's torch signalled the end of a great construction project and the beginning of an even greater industrial story.

The final weld on Westcoast Transmission Company's $170 million pipeline linking the gas-rich Peace River fields to southern British Columbia and northwestern United States, opened the floodgates for a river of energy that is pumping new life into the economy of the area. Even now, its presence is attracting new industries, payrolls and population, and such is the demand for this recently tapped fuel supply that a $100 million addition was planned even before the line was finished. It will increase its capacity by more than 50 percent.

In its initial operating phase, the Westcoast line is delivering 400 million cubic feet of gas per day. When additional compressor stations are added, its capacity will be raised to 660 million cubic feet per day. Much of this added output will go to Pacific Northwest Pipeline Corporation whose line from the San Juan Basin of New Mexico also terminates at the U.S.-Canadian border. Pacific Northwest has contracted for an additional 350 million cubic feet of surplus gas a day, and both the British Columbia Electric Company, Ltd., and Inland Natural Gas Company, Ltd., distributors for British Columbia areas, have exercised their options to take substantially larger volumes.

Westcoast Transmission is a pioneer of the "big-inch" natural gas industry in Canada. Its 30-inch line is the country's first major carrier of natural gas, and by unlocking the Peace River reserves and bringing them to market, it has acted as a tremendous stimulus to exploration for gas and oil in the vast northern areas of British Columbia and Alberta. Because it is linked to a pipeline network in the United States extending south to California and east to Texas, Canadian pro-



WESTCOAST MAP

Above is shown the route of Westcoast Gas Transmission Company's line from the Peace River Field to Huntingdon, B. C., on the Canadian-United States Border.

COMPRESSOR ON THE MOVE

All equipment for Taylor Station (Station 1) had to be trucked in along the Alcan Highway. This scene shows one of the big Ingersoll-Rand 412 KVS units en-route. As shown here, bridge restrictions on weight often meant that part of the heavy load had to be taken by another truck backing along behind the rig.

ducers find themselves in an enviable market position. The export arrangements already concluded assure British Columbia consumers of natural gas service at a price much lower than could otherwise exist. Indeed it is doubtful if a pipeline into the western provinces could even have been considered without the United States link because demands in British Columbia at the present are not sufficient to make a line economical. The rich Washington-Oregon market, however, was well worth the expense and effort. Thus British Columbia has the chance to fully develop natural gas uses and to take advantage of the recently developed fuel supplies.

Frank M. McMahon, Westcoast Transmission Company's president, and a native of British Columbia, conceived the idea of the pipeline more than 20 years ago and began engineering and market studies at that time.

The next step was to prove natural gas reserves in the Peace River area. The Canadian government opened it to private exploration in 1947. Permits 1, 2, and 3 were issued to McMahon in the name of Peace River Natural Gas Co., Ltd. The first significant find was made November 1, 1951, when Pacific Fort St. John 1 was brought in. It was the discovery well of a vast new field and proved the feasibility of McMahon's line. More than 2 years ago, the conservative estimates of qualified American and Canadian geologists placed reserves at 5000 million cubic feet and emphasized that the surface has barely been scratched.

With supplies assured, authorizations were next needed. Getting these was a marathon task involving hearings in Alberta, Ottawa and Washington, D.C. From 1949, when Westcoast Transmission Company, Ltd., was incorporated by a Special Act of Parliament, until the time Mannix, Ltd., construction crews began laying pipe in the Fraser Valley of British Columbia, more than 6 years had passed.

On October 1, 1955, the tools of the pipeliners—the lumbering side-boom tractors, the trenchers and wrappers, the compressors and rock drills, the ditchers and back-fillers—swung into action. Ford, Bacon & Davis, Inc., were appointed as engineers for the project and as designers of compressor stations and metering facilities, and Canadian Bechtel, Ltd., became the agent and manager of construction for Westcoast.

The massive job of building the line was divided into four contracts. Schedule One, the northern 120 miles, was awarded to Dutton-Williams Brothers, Ltd.; Schedule Two, the next 210 miles, to Canadian Bechtel's construction division; Schedule Three, 210 miles, to Conyes Construction Corporation; and Schedule Four, the final 110 miles terminating at the international border, to Mannix, Ltd.

The estimated cost of four compressor stations completed for the initial operating phase is $22 million. Construction of Station 1 was handled by Stearns-Roger-Marwell, a joint venture of Stearns-Roger Engineering Company, Ltd., and Marwell Construction Company, Ltd. Work at the other three stations was done by Stearns-Roger-Dutton-Williams, also a joint venture of Stearns-Roger, but in combination with Dutton-Williams Brothers Limited. Under the announced expansion plan, four additional stations will be constructed to bring the line to its full capacity of 660 million cubic feet per day. Stations are numbered from 1 to 8, the odd-numbered ones being completed and the others, planned. On the map that accompanies this article are shown the four planned stations. A fifth will be located some 40 miles north of Taylor and will be designated as a gathering station.

Station 1, at Taylor Flats, makes use of all reciprocating equipment. Six Ingersoll-Rand 412 KVS gas-engine compressor units handle the peak load of 660 million cubic feet of gas per day. The station also includes Ingersoll-Rand instrument and starting air compressors, fresh-water feed and circulating pumps.

Station 3, near Fort McLeod, uses four engine-driven centrifugal compressor units. (A speed increaser is used between the gas engine and centrifugal compressor.) Two Ingersoll-Rand 10 PSVG gas engines drive 500-kw generators. I-R starting and instrument air compressors, as well as circulating pumps, are also used.

This installation is duplicated at Station 5, near Australian, B.C., and again at Station 7 near Savona with the exception that three gas-engine-driven centrifugal compressors and only one 500-kw generating unit are used. Electric power for this plant is being supplied from the local utility company. The 500-kw generating plant is, therefore, a standby facility.

Although the line traverses some of the most scenic country in North America, no construction or operating difficulty was encountered that had not already been met and dealt with in pipelining jobs in the United States. Its greatest elevation, in the Boston Bar Pass of the Coast Range, is only 4700 feet, and its other major mountain climb, the Pine Pass through the Rockies, reaches only the 3300-foot level.

The main Westcoast line starts its journey southward at Taylor, B.C., just outside Fort St. John (Station 1). Here natural gas from the fields in Alberta and British Columbia merges and is processed in a $30 million plant. The "wet" British Columbia gas is rich in liquid hydrocarbons such as propane and butane and in hydrogen sulphide, and the plant that processes these has provided the North with its largest industry.

Also located at Taylor is a refinery built jointly by Pacific Petroleums, Ltd., and Phillips Petroleum Company for the manufacture of propane and a complete line of motor and aviation fuels. In addition, Jefferson Lake Sulphur Company has built a plant to process hydrogen sulphide into elemental sulphur at an initial rate of 300 tons a day.

When the clean, dry pipeline gas leaves the scrubbing plant, it moves into the 30-inch main transmission line, joins the gas stream from Alberta and passes through Station 1, beginning its 650-mile journey.

Almost immediately, the line takes to the air on a graceful suspension bridge that carries it across the Peace River. This span, also carrying a 26-inch line to bring incoming gas from the Alberta fields to the compressor station, is 1675 feet between towers—longer than the clear span of Vancouver's famed Lions Gate Bridge—and is, therefore, the longest suspension bridge in the British Commonwealth.

From the river crossing, the line bears west and south through the rolling Peace River valley and plunges under the Pine River in a major submarine crossing at Milepost 32. Thereafter, beginning its climb to the Pine Pass summit at Milepost 75, it parallels the Pacific Great Eastern Railway and the all-weather John Hart Highway.

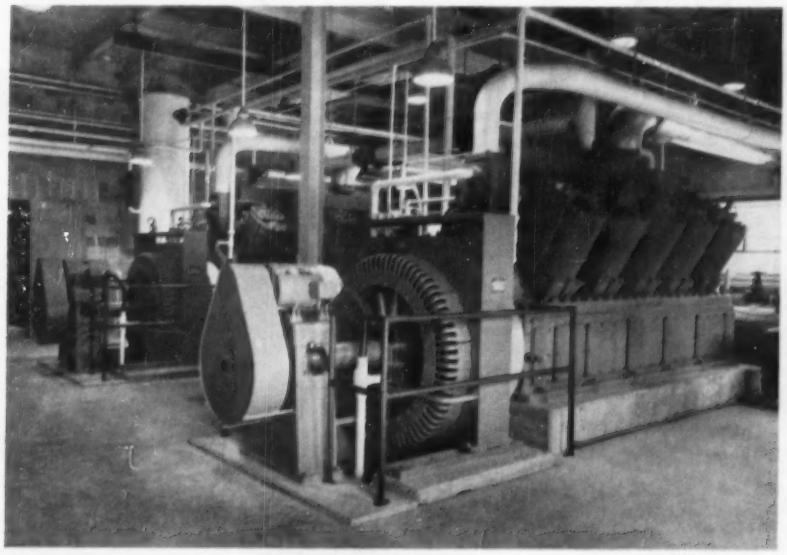
It crosses the Rockies at an elevation of 2900 feet and continues through rough, timbered, sidehill country to a submarine crossing of the Parsnip River at Milepost 144. Then, passing through Fort McLeod it begins a gradual descent through picture-postcard scenery of winding river systems and densely forested lakelands to the Prince George area. The rolling Fraser River is bridged east of Prince George on a 1300-foot suspension span, and the line follows the river's east slope down to Milepost 300, where it crosses the Quesnel River on a 1200-foot bridge. Then it moves out into the fabled Cariboo ranching country through dense timber and deep canyons and begins its climb to the high plateau country near Williams Lake.

Onward to 100 Mile House on the old Cariboo Trail, the pipeline enters remote terrain of rugged beauty, dips under the Bonaparte River and reaches the top of the plateau—4250 feet—at Hihium Lake. Then it begins a slow downward trend until near Savona, where it follows the canyon of Deadman Creek. Near this point, at Milepost 483, another suspension bridge spans the Thompson River, and as it makes its way to Merritt, the line enters hilly country where Douglas fir and spruce, of diameters as great as 4 feet, flourish.

From Merritt, the line follows the Clearwater River almost to its headwaters, probes upward into the Cascade range through eighteen minor crossings of the Coquihalla River and enters the Boston Bar Pass. Here, far above the silvery ribbon of the river below, it reaches its greatest elevation—4700 feet.

Thereafter, the going is all downhill, into the community of Hope at Milepost 600, across the Fraser again on a suspension bridge at Flood, and into the bottomland near Agassiz. The final river crossing is made on the 4000-foot Agassiz-Rosedale highway bridge, and at Milepost 650, near the border towns of Huntingdon, B.C. and Sumas, Wash., the line is connected to Pacific Northwest's "Scenic Inch" from the San Juan Basin.

The Westcoast line originally was scheduled for completion in November 1957. It was completed nearly 3 months sooner, however, by a construction force that reached a summertime peak of 2200 men during each of the 2 big building years. Seven million tons of earth were moved and 230,426 tons of steel pipe were used to get the job done. When finished, rewards beyond the tangible ones could be claimed by the builders, for their labors had helped to bring to reality a demonstration of international coöperation at its finest: the mutual development of dormant natural resources for the mutual benefit of two great sister nations.



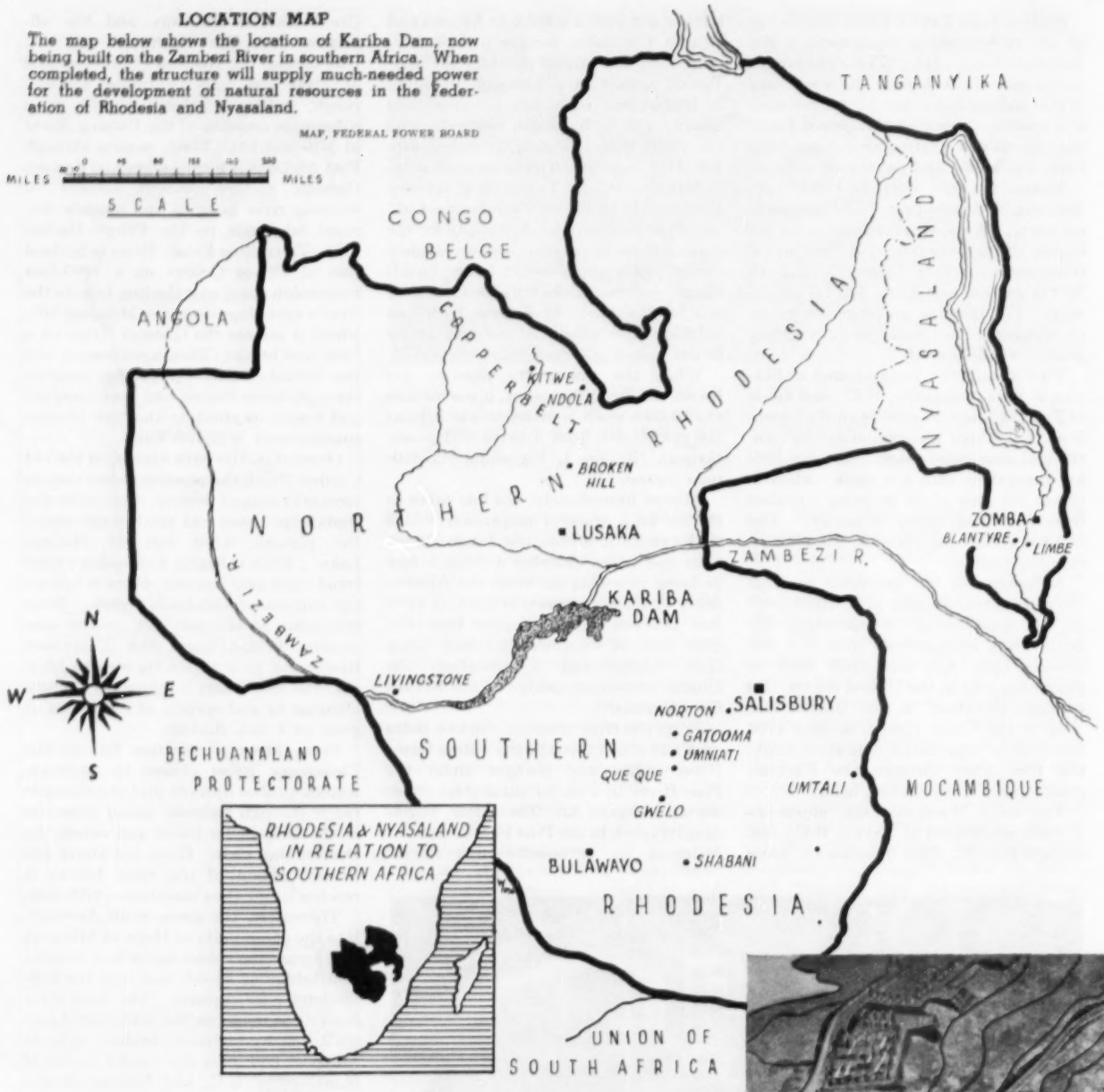
ELECTRIC POWER SUPPLY

The machines shown in this illustration are Ingersoll-Rand PSVG-10 units driving General Electric 500-kw generators furnishing power for Station 5, near Australian, B. C. The installation is duplicated at Station 3 and another unit is in operation at Station 7. Power at Station 7 is supplied by the local utility, thus the gas engine-generator set there is for standby capacity only.

LOCATION MAP

The map below shows the location of Kariba Dam, now being built on the Zambezi River in southern Africa. When completed, the structure will supply much-needed power for the development of natural resources in the Federation of Rhodesia and Nyasaland.

MAP, FEDERAL POWER BOARD



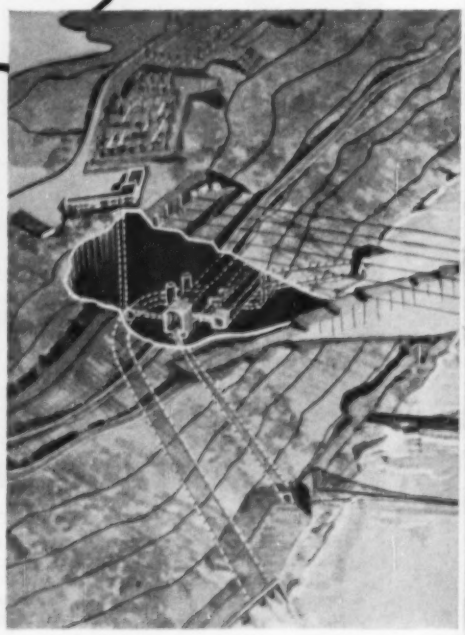
Harnessing The Zambezi

New Hydro Power Plant To Aid Copper Production

R. W. Sapora

IN THE Federation of the Rhodesias and Nyasaland, about 300 miles below Victoria Falls, a gigantic concrete arch dam is being built across the Zambezi River. It is the first effort to utilize the vast hydroelectric potential of the Zambezi, and the completed plant will be the largest of its kind in Africa.

The construction of this dam will solve the immediate power problems that have limited the production of copper and other metals in the Federation. The Copperbelt, an area of about 450 square miles in Northern and Southern Rho-



desia, is thought to have about one-fourth of the established copper ore reserves in the world. The Federation's mineral and agricultural resources provide a good foundation for industrial expansion, although before development can be fully realized, not only power, but better roads and communications must also be provided.

Two dams were considered in the area —the one at Kariba Gorge on the Zambezi, and the other on the tributary Kafue River. These projects were examined independently by experts of world repute, who reported that although both were sound, Kariba was the better. The government of the Federation announced in March 1955, that the Kariba Dam would be built first, and a preliminary construction contract was awarded the Cementation Company, Ltd.

The structure is being built about 2½ miles downstream from the entrance of Kariba Gorge, a narrow, 16-mile stretch where the river flows between steep hills. A few more feet of head could have been obtained by locating the dam at the downstream end of the gorge, but exploratory drilling at the upper end revealed better rock at the river bed level. The 1900-foot dam will be 420 feet high, and will raise the dry-weather level of the river 340 feet. A reservoir will be created that will extend 175 miles to the south, impounding about 130 million acre-feet of water—approximately four times the capacity of Lake Meade, above Hoover Dam, on the Colorado River. The resultant lake will have a total surface area of 2000 square miles. It will necessitate the resettlement of about 51,000 Africans, most of whom are primitive Tonga people. A limited amount of resettlement has already taken place, although there is considerable doubt among the natives that this effort to tame the mighty Zambezi will be successful.

Upon completion of the dam, the firm flow available for power will be about 29½ million acre-feet per year, or a continuous flow of 48,800 cfs (cubic feet per second). Two power stations will be constructed, one on each bank of Kariba Gorge. Six turbo-generators will be located in each station, with a total installed capacity of 1200 megawatts. Only two existing dams have greater capacities—the Grand Coulee and Hoover dams in the United States.

The flow of the Zambezi varies from 16,000 cfs in the dry months to about 200,000 cfs in the rainy season. To permit construction of the main dam, a part of this discharge is passing through temporary openings in the concrete base of the already completed northern portion of the structure. The remainder is

PHOTOS, FEDERAL POWER BOARD

KARIBA DAM

Artist's conception (left) of the dam as it will appear by dry water season, 1958. The view immediately above was taken from the air during the breaching of the north bank cofferdam in July 1957. Water is now being diverted through the temporary openings as shown in the view at the top, and through a by-pass tunnel in the opposite bank that is not pictured. The main section of the dam will be built within the cofferdams, now beginning to take shape toward the south bank.

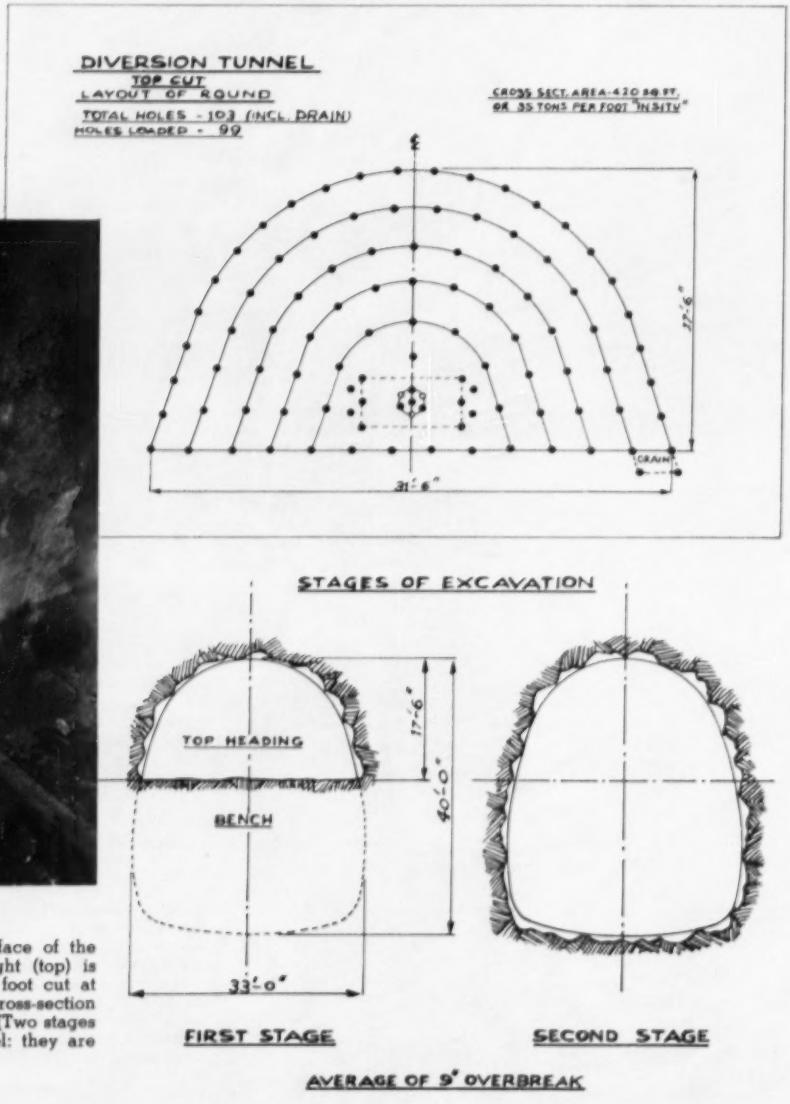
being directed through a 1300-foot-long diversion tunnel, 40 feet high and 33 feet wide, excavated in the south bank of the river. The floor level of the tunnel was established at 1200 feet, mean sea-level datum. The normal flood level of the river in rainy season, however, is 1300 feet. This tunnel was so important to the over-all program that construction had to be continued through high-water periods. Therefore, the contractor elected to drive an approach adit from an elevation of 1325 feet. It dips 1 foot for every 6½ feet over a distance of 877 feet. This adit was 14 feet high and 18 feet wide so that it could accommodate the compressed-air main, drilling-water line, pump-discharge column and ventilating pipes, and still leave room for the operation of trackless muck trucks.

It was decided to drive a top heading, measuring 17½ feet high, over the full 31½-foot width of the diversion tunnel. Thirty-five tons of rock per foot of advance were produced. Air-leg drilling from mounted platforms was the method used. The top heading, exclusive of rock plugs left at both ends, was completed in May 1956, and the second stage of excavation was completed in August 1957. The rock was gneiss, requiring little reinforcement except for steel arches at the portals. All doubtful

AIR SUPPLY

Four of the 23 Ingersoll-Rand portable Gyro-Flo (rotary) compressors in use at Kariba Dam. These supplied part of the air for driving the diversion tunnel in the south bank of the river.

DIAGRAMS, SOUTH AFRICAN MINING AND ENGINEERING JOURNAL



DRILLING OPERATIONS

Above is shown drilling in progress at the face of the now completed diversion tunnel. At the right (top) is shown the drill pattern adopted to pull a 9 foot cut at each blast or about 350 tons of muck. The cross-section represents the 420 square feet of the top cut. (Two stages of excavation were used in driving the tunnel: they are illustrated at the right.)

ground was secured by placement of roof bolts.

Equipment for driving the tunnel included 23 Ingersoll-Rand portable Gyro-Flo (rotary) air compressors of various sizes, 6 V-belt-driven Type 40 compressors, 2 wagon drills, 28 Jackhamers, 28 paving breakers, several hoists, sump pumps and a quantity of 1¾- and 2-inch I-R Carset (tungsten carbide insert) Jackbits. Two Eimco No. 105 track-mounted diesel engine loaders for mucking and a number of Kochling Dumpsters equipped with 110-hp General Motors diesel engines were used.

Since the low-water season lasts from July to December, the construction of the dam is presently in its critical period. Cofferdams are being constructed in the riverbed during this time to a height sufficient to permit work on the center section of the main dam with only a slight chance of flooding during the wet season. The higher the main dam can be raised during the dry season of 1957, the less the risk will be.

Although the Kariba project is primarily a hydroelectric scheme, a great deal of consideration has been given to other uses. Thus far, commercial fishing seems to offer the greatest possibilities. Clearing all the lake bottom for this purpose would be enormously expensive, and it is likely that only selected areas will be fitted to meet the requirements of various fishing methods. Forestry, transportation, irrigation, research and tourism are additional possibilities that are being studied.

The project is scheduled to produce its first power in 1960. By that time, about 600,000 tons of all types of material will have been transported to the area. Of this, 420,000 tons will be cement, all supplied from within the Federation. The first-stage costs of the project are estimated at $226,000,000 although rising material costs and unforeseen construction difficulties could change this figure considerably. Adequate reserves have been established to meet such conditions. The total cost of the scheme is estimated at $317,000,000. Financing of the project has been undertaken by the World Bank, Colonial Development Corporation, Commonwealth Development Finance Company, Northern Rhodesia copper mining companies, several Federation banks and the Government of the Federation of Rhodesia and Nyasaland.

The project is being built by the Federal Power Board, under the chairmanship of Mr. Duncan L. Anderson, C. B. E., T. D., M. I. Struct. E. The joint consulting engineers are Gibb, Coyne and Sogei (Kariba) Limited, and the consulting mechanical and electrical engineers are Merz and McLellan. The main civil engineering contract was awarded, on tender, to Impresit (Kariba) Limited.

FRANCIS DONALDSON

1958 MOLES AWARDS TO CONNOLLY, DONALDSON

PETER F. CONNOLLY

PETER F. Connolly, Osterville, Mass., and Francis Donaldson, Bronxville, N.Y., have been named the 1958 recipients of the awards given annually by the Moles, a New York association of leading figures in the tunneling and heavy-construction industry, for "outstanding achievement in construction." Formal presentation of the honors will be at the annual Moles Awards dinner January 29. Connolly and Donaldson make up the 18th pair of honorees in a series that started in 1941, Donaldson being the traditional nonmember winner.

The two men share a total of more than 110 years of construction experience, much of it dealing with tunnels. Connolly is president of The Peter F. Connolly Company and has been primarily concerned with pneumatic caissons and tunnels in a construction career that started in 1902 on the East Boston Tunnel. He started his own firm in 1908. In the early 1930s he was awarded, in a joint venture with Patrick McGovern, Inc., a then record $44 million contract for tunnels for the New York City Board of Water Supply. During the last 20 years Peter F. Connolly Company has been responsible for a steady stream of important jobs: a pneumatic tunnel under River Rouge in Detroit; another air tunnel under Wellington Bridge in Boston; foundations and piers, built under compressed air, for the Thomas A. Edison Bridge over the Raritan River in New Jersey; another pneumatic tunnel under the Mystic River in Boston; and, perhaps the most spectacular of all, the pneumatic caissons for a new railroad bridge over the Harlem River in New York City. The latter job has been rated as one of the most difficult caissons ever put down in this country; it had the added problem of maintaining a clear passage for some 650 trains each day.

Donaldson has been vice president and director of Mason & Hanger, New York construction firm, since 1936, but he had put in a full quarter-century of distinguished construction service even before that date. One of his best-known accomplishments was in designing braced open cofferdams that solved difficult problems in the foundations of the New Jersey towers for the George Washington Bridge. He has played a prominent role in the construction of all three tubes of the Lincoln Tunnel, of the Manhattan section of the Brooklyn-Battery Tunnel and many others, including the Ray's Hill Tunnel on the Pennsylvania Turnpike.

He began his construction career in 1901 with the Dravo Corporation, becoming chief engineer of that firm in 1908. He joined the Mason-Hanger organization in 1926.

Modern Covered Wagons

FLUID POWER SPECIAL

One of Miller Fluid Power Company's bus colleges designed to demonstrate the advantages of air-powered equipment to users in their own plants.

ORE-TESTING FACILITIES

Inside the truck body is a completely equipped 8x16-foot laboratory for field testing samples of minerals and working out full-scale treatment processes.

FIBERGLAS ROAD SHOW

The latest Owens-Corning traveling display for architects, contractors and engineers. A previous model covered 60,000 miles in this country and Canada and attracted 70,000 visitors.

MAYBE the world will beat a path to the doorstep of the man that builds a better mousetrap, but modern manufacturers think it might take a long time for that to happen. Instead of waiting, they prefer to "beat the bushes" for buyers, and in doing so they avail themselves of every possible selling aid, including mobile displays. Since the days of horse-drawn vehicles hucksters have put their stores on the road, and now the makers of engineering products are adopting the same idea, but mainly for demonstration purposes.

In the compressed-air field, Miller Motor Company, of Melrose Park, Ill., (now a division of Flick-Reedy Corporation) pioneered this sort of thing 9 years ago with its "College of Cylinder Knowledge" on wheels. It began as a converted trailer pulled from plant to plant and to trade shows by a passenger car. The purpose was to familiarize factory foremen and engineers with cylinders and their applications. Before long, four buses were made into mobile classrooms. Recently four new ones have been air conditioned and outfitted. Also, colleges have been added to the itinerary. Eighteen "students" can be accommodated at a time in seated comfort. More than 300,000 persons have taken the "course" to date. Every "graduate" receives a diploma.

Owens-Corning Fiberglas Corporation uses an air-conditioned truck trailer to show its products for industrial maintenance at major plants. Even the trailer body is built of Fiberglas-reinforced plastic panels, the walls contain 2 inches of Fiberglas insulation, and there are Fiberglas acoustical boards in the ceiling.

An "Abrasive Workshop" outfitted by The Carborundum Company returned to its base at Niagara Falls, N.Y., last year after 22 months on the road and was reëquipped with later-model abrasive belt machines before starting out again. On its first swing it traveled 24,000 miles in 44 states and gave 1157 demonstrations to 10,000 persons in industrial establishments.

Denver Equipment Company, a specialist in ore-dressing equipment, builds a portable testing laboratory for service in the field. A typical setup includes crushers, a ball mill, jigs, flotation machines, a concentrating table and other essential machinery for sampling and testing new deposits or tailings dumps and for developing flow sheets for treatment plants. The unit has its own power plant, and each machine is operated by a separate motor. The laboratory is designed for use by governmental exploration parties or by operating mining concerns, especially those with widespread holdings. It is offered with or without the truck, and may be modified to meet individual needs.

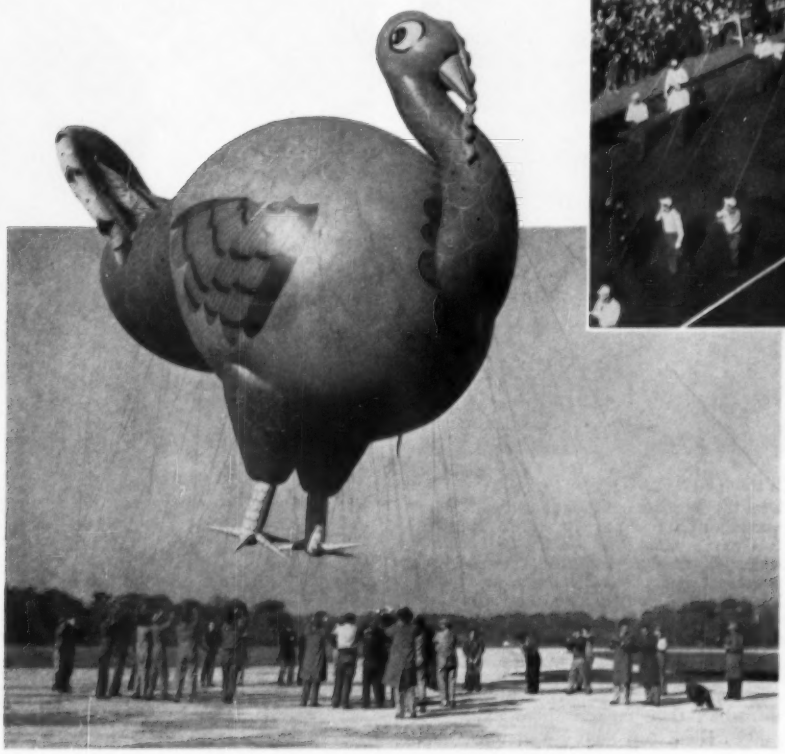
Imagery Afloat

The balloons of R. H. Macy & Company's Thirty-first annual parade opened the Christmas Season for millions of Americans

S. M. Parkhill

IT CAME FROM OUTER SPACE

"Spaceman" greeted delighted youngsters in Macy's 1953 parade—the twenty-seventh traditional pre-Christmas event. Despite their immense size, the balloons are handled with ease when inflated. During the parade they float about 20 feet above the crowds and are held in tow by costumed ground crews.



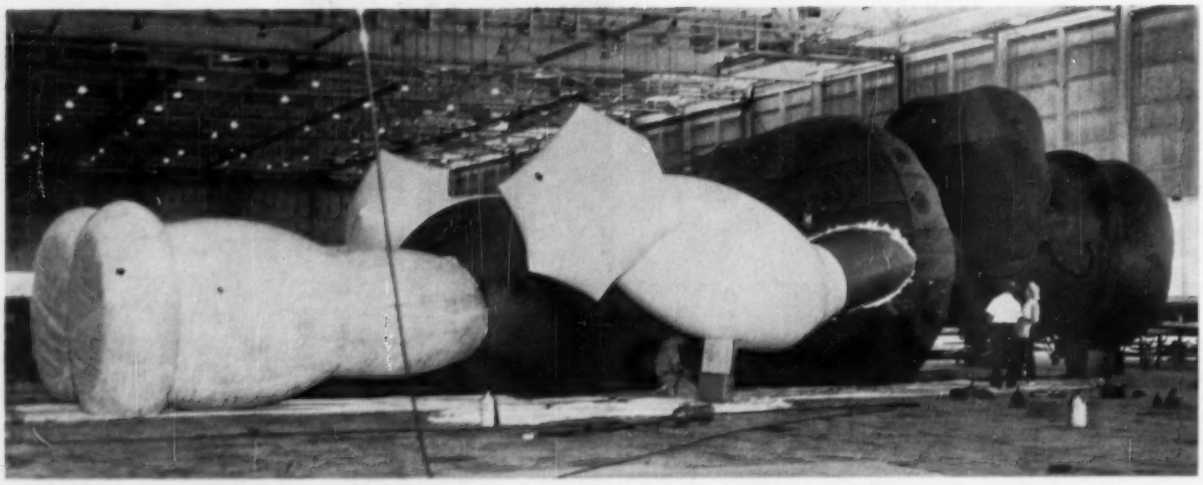
IT TAKES A LOT OF STUFFING

To fly, "Gorgeous Gobbler" needs to be filled with 13,500 cubic feet of helium. The bird, who made her first appearance in 1954 in the annual Macy parade, weighs 305 pounds and is made of 850 yards of rubberized fabric. A live turkey of this size, it is estimated, would weigh 5200 pounds and could feed that many people on Thanksgiving Day.

FOR MANY, the Christmas holidays last longer than the caroled 12-day period. For the children of New York City, for example, the season officially begins on Thanksgiving Day when Santa Claus, accompanied by clowns, marching bands, floats and huge balloons, comes down Broadway in R.H. Macy & Company's annual parade. For the people at Macy's department store, where St. Nick is in residence until Christmas Eve; for designers; and for engineers and craftsmen at Goodyear Tire & Rubber Company's facilities where the inflated images take form and are tested, the season begins in summer.

The first pageant was conceived in 1926 and live animals were borrowed from a local zoo. Instead of enthralling the youngsters that stood along the parade route, they frightened them. Consequently, Tony Sarg, famous New York cartoonist and marionettier, was called to give a helping hand. He had a creative background of making large papier-mache representations of childhood storybook heroes. It became his task, in the spring and summer of 1927, to design balloons that could be used the following November. He did the job, and the contract for making them was given to Goodyear. At a later date, Walt Disney's talents were utilized, and he recreated his Mickey Mouse, Pluto the Pup and Horace Horsecollar to delight the children.

Once the characters have been chosen from comic books, fictional stories, television programs and the like, the designs



FINAL CONSTRUCTION STAGES

As the first of November approached, work on the most recent creation for R. H. Macy & Company's parade neared completion at Goodyear Tire & Rubber Company. "Popeye" made his debut in this year's event. At the top he is in the process of being painted. The man kneeling by the boxes in the foreground has a forearm above him that is 7 feet in diameter. The 11-foot jawbone is barely recognizable, however, in a more complete stage of construction (bottom) it is clearer. Thirty-three gallons of red, white, blue and black paint were used to cover the 56-foot-high figure; and as he floats down the streets of New York, he will be filled with 6000 cubic feet of helium.

STANDING TALL

As if he were guarding the map of the world behind him, "Soldier" stands at attention in the gymnasium of Goodyear Tire & Rubber Company's facility. The room is the only indoor area there large enough to handle the big balloons.

are drawn. These are sent to Goodyear's plant where, in a tradition of balloon making that dates from the First World War, they are executed. Annually since 1927, with the exception of 4 years during the Second World War, at least one new creation has been added. Each image was, at one time, made of a fabric that was rubberized on both sides. Each had a life expectancy of about 4 to 5 years. Later models have been constructed of neoprene-coated nylon. It is estimated that these will have a longer existence.

Other factors, however, enter into the determination of how long the balloons will be used. The amount of paint that has to be applied to them each year to refreshen their appearances eventually makes them top heavy and unmanageable. Popularity is also considered when scrapping of a balloon is contemplated. Everyone concerned with the parade has the children's interests, likes and dislikes as guides in his work.

The inflated characters were not always kept from year to year. In the 1930s, it was the custom to release them and to award prizes to the lucky persons who found and returned them. One year, a dragon that had been used blew out to sea and was lost in the Atlantic Ocean. Shortly thereafter, newspapers were flooded with reports from ships that they had sighted a sea monster.

This year, five balloons were used, four of which were seen before. *Soldier*, *Gobbler* and *Spaceman* made their debuts in the early 1950s, and *Observer* proved its popularity in 1956. *Popeye*, the fifth creation, made his entrance this year.

Observer was the first device that carried a man aloft in these parades, and the professional stunt man aboard was

the first to float down the canyoned streets of Gotham. The structure resembles the observation balloons used during the Civil War and is not unlike the size and shape of the paraffin and tissue balloons of the eighteenth century. It consists of a special steel-ringed basket, encased in rubberized fabric, suspended from an air bag. About 24 persons, holding nylon lines, are required to keep it, and its sole occupant, from free flight. The bag is made of 325 yards of single-ply, neoprene-coated nylon fabric of a type similar to that used in military airships. Over-all weight of *Observer* is a little more than 150 pounds, the basket contributing a third of this amount. Ten thousand cubic feet of helium are needed to inflate the 35-foot-high, 28-foot-wide balloon.

Work began on *Observer* in August of 1956 in Goodyear's Aviation Products Division. Draftsmen designed the 51 patterns that make the huge envelope, figured the shape of three appendixes for inflation, and laid out the details of the basket. Skilled airship builders received the drawings and spent a full month painstakingly cutting and seaming the patterns. At the same time, 28 holding patches were prepared for the nylon guide lines, and another 28, onto which ornaments and the three appendixes were attached. By early October, assemblers were called to Goodyear's spacious gymnasium to put the balloon together—the only indoor facility that was large enough to accommodate *Observer* during inflation. Each seam is hand lapped and fastened with air-cured neoprene cement. After it was puffed up, it was painted in four brilliant Day-Glo fluorescent colors. Twenty gallons were required. After about 100 days of working on the structure, it was taken to Wingfoot Lake Airship Base for a test flight before being sent to New York.

TEST FLIGHT

After fabrication at Goodyear's Aviation Products Division, "Observer" was tested (below) at Wingfoot Lake Airship Base before being sent to New York City and its first flight down Broadway last year. Painted in four brilliant colors, it was designed to look much like Montgolfier's hydrogen balloon of 1783. In its small basket, a professional stunt man floated down the man-made canyons of Gotham for the second time this year.

Spaceman is a 70-foot-high balloon that was introduced in 1953. He measures 40 feet in width and required 600 yards of rubberized fabric. Twenty-five gallons of paint were needed to cover him. His body is black, and his head, legs and feet are aluminum colored. So that *Spaceman* can float down the street, 15,000 cubic feet of helium are pumped into him.

Gobbler, measuring 50 feet from the bottom of her feet to the top of her head, and a similar distance from the tip of her tail to her wishbone, made her maiden trip down Broadway in 1954. To become airborne, this 305-pound giant with her 28-foot rainbow-colored tail must be inflated with 13,500 cubic feet of helium. According to engineers at Goodyear, a live turkey of the same size would weigh about 5200 pounds and would lay an egg that would be 6 feet in diameter and 10 feet long. Twenty-eight pieces of fabric make up the body, and there are sixteen more in the head—850 yards in all. Each section was inflated separately for painting, and more than 30 gallons of pink, grey, red and yellow paint were used to cover her. She flies, as do the other balloons, about 20 feet above the spectators, held at this altitude by a costumed ground crew of 42 men.

Three months were required for *Gobbler's* construction—a total of 1000 man-hours. As with the other images, first the pattern was made, then hand cutting and seaming were done. Forty-two holding patches were attached. The placing of these is of extreme importance. Depending on their positions, the characters will fly at an upright angle. Misplacement would mean that the balloons would tilt in unnatural attitudes and could possibly blow out of control.

Popeye, that lovable cartoon character who has made spinach eaters of countless children, appeared this year. He is 56 feet high and 32 feet wide. The much-traveled sailor has 6-foot square hands, forearms 7 feet in diameter, a 16-foot chest and a 9-foot waist. His feet are 10 feet long, he measures 16 feet across the shoulders and has a 21-foot reach. Atop *Popeye's* 5-foot neck is a 14-foot head with a pinky nose 3 feet wide and 3½ feet long.

Another distinguishing Popeye trademark, his pipe, is 4 feet long. The 16-inch-diameter, 18-inch-high bowl, has 3 cubic feet of space that would hold 80 pounds of tobacco, if it were real.

To inflate *Popeye*, who weighs 250 pounds deflated, more than 6000 cubic feet of helium is required. Inflated, he

has a buoyancy of approximately 110 pounds, free lift.

More than 600 yards of neoprene-coated nylon fabric, representing 243 patterns, were required to build him. Twenty-three patches hold a like number of lines for a ground crew of 25 persons. In excess of 1000 man-hours were required to cut, seam and assemble *Popeye* at Goodyear Aircraft Corporation's Litchfield Park, Ariz., plant, where envelopes for nonrigid airships are made. To paint him took 10 gallons of blue, 5 gallons of red, 1 gallon of black and 17 gallons of white pigments. More than 25 gallons of neoprene air-curing cement were used to put him together. Work began September 1 and was completed November 4. He was test flown at Wingfoot Lake Airship Base, Akron, Ohio.

In general, Macy's has had good luck with Old Man Wind. In 1956 however, gusts whipped through Manhattan. These 25-mph blasts flattened all three of the parade's balloons. *Gobbler* was the first victim and *Observer* the second. Both brushed against trees and lamp-posts and quickly deflated. *Mighty Mouse* flexed his muscles until nearly the end of the festivities, however he too lost his 10,000 cubic feet of helium and became quite a small mouse, indeed. The parade, more than just a group of balloons, consisted as usual of gay floats, thumping bands and about 4000 marchers. It continued, and the Christmas holidays began for thousands of delighted onlookers.

Some of the floats have been quite intricate. For example, a 3-part circus tableau has often been used. The first section of it resembles a crescent-shaped bandwagon and is pulled by a fanciful giraffe with a 17-foot neck and a mane made of 50,000 amber-colored drinking straws. This is followed by the side show that looks like a gaslit theater. A hobo band forms the third part.

Another is a 3-section unit called Starlight Starbright. First is an 11-foot-high aluminum-colored reindeer with a 10-foot antler spread. The second portion consists of a 20x8-foot ice skating rink on which professional skaters perform. The rink is kept from melting along the route by a specially constructed refrigeration unit in the recesses of the float. Towering above the performers is an 18-foot-high glass Christmas tree, atop of which is a 7-foot star. On the final section, perched high on a red velvet throne surveying the winter wonderland with his customary contempt for all things sentimental, sits Scrooge.

One float depicts a 48-foot-long flower garden ablaze with orange and gold chrysanthemums. It is presided over by Mistress Mary. Unique on this display is a fountain that sprays 2000 gallons of water an hour 10 feet into the air while moving down the street.

The climax of the parade is, of course, St. Nick, riding on a heavily jeweled sleigh that is mounted on oak and iron runners and upholstered in soft, white plush. He is pulled by hand-sculptured prancing reindeer, each in a different pose.

The night before each Thanksgiving Day, when parents are tucking excited children into bed, helium from two large semitrailers is tapped and the long process of inflating the images begins. Great quantities of the gas are needed. In 1956, for example, 40,000 cubic feet of it were used to inflate three balloons. *Observer* was relatively easy—the others took longer. Four hours were required to fill the twelve individual balloons that made up *Mighty Mouse*.

On parade mornings, the festivities begin. Thousands of youngsters line the street, and thousands more press their noses against the window panes of stores that line the parade route. Many of the latter are members of special parties given by various business firms and department stores along Broadway. Since the advent of television, the traditional balloon parade has accumulated millions of spectators. With the arrival of Santa, in all his traditional holiday color and gaiety, the annual Christmas season officially begins, at least for the children of New York. For Gotham's adults, too, the streets seem a little brighter.

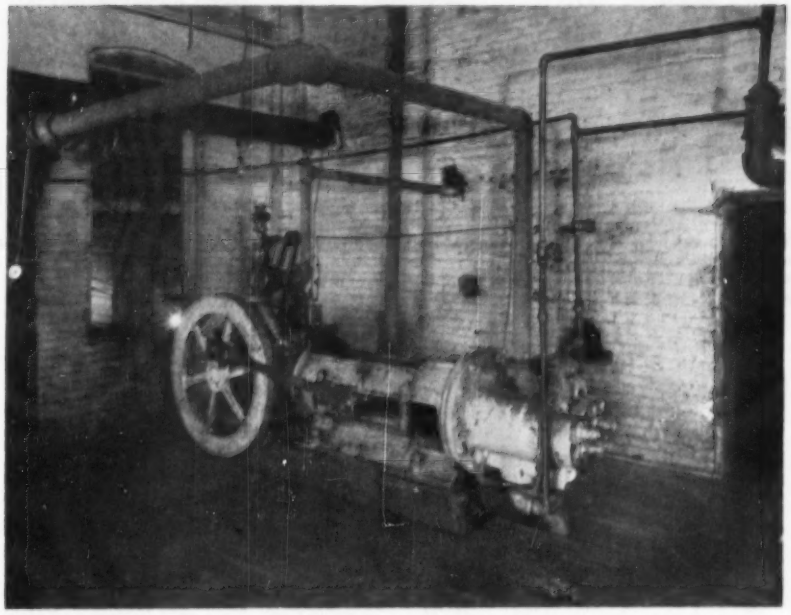
RISING TO THE OCCASION

Climbing up the ladder to his plush seat, St. Nick is preparing to ride down Broadway to Macy's department store. He and his float are the climax to the parade. Each of the reindeer that are pulling the sled was especially handcarved for the float and is covered with glistening powdered glass and aquamarine jewels.

Still serviceable, Early Rand compressor Retires after—

FIFTY-TWO YEARS ON THE LINE

Terry Henshaw



RETIRED COMPRESSOR

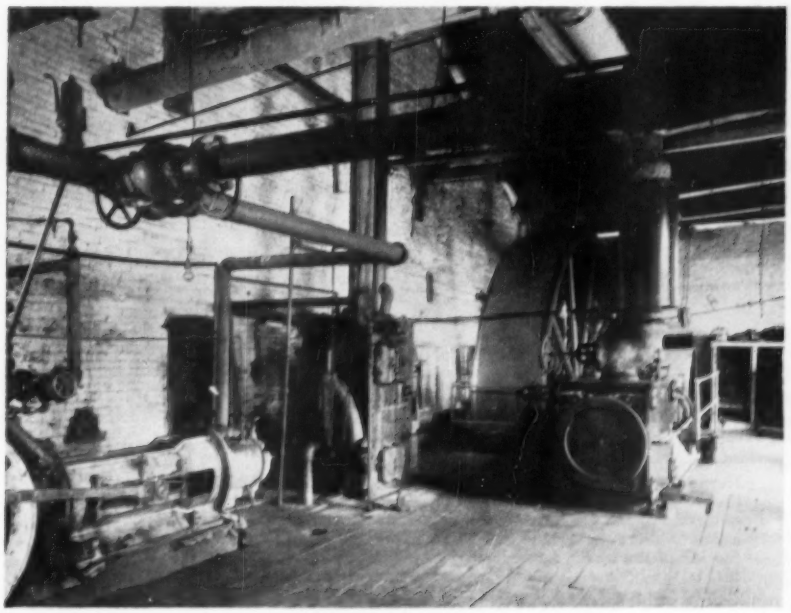
Shown above, in its Foster Lumber Company home, is a Rand Class C compressor. It has one 12x16 steam cylinder and one air cylinder of the same size. The unit was built in April 1905 at the firm's Painted Post facility and shipped to Texas where it has given continuous service.

IN 1905, a mill of the Foster Lumber Company was built in the small Texas town of Clinesburg (later called Fostoria), about 50 miles north of Houston. A Rand Drill Company compressor installed at that time is still in good running condition. A straight-line, single-stage Class C unit, steam-powered, it supplied air to the machine and repair shops, and was used for lifting water in the company's wells. With 12-inch-diameter air and steam cylinders and a 16-inch stroke, the compressor has a rated capacity of 168 cfm at 80 psi and 120 rpm. The power cylinder requires steam at 125 psi.

Quoting from an early Rand Drill Company air and gas compressor catalogue, the Class C units were designed to "meet a demand for small steam-driven compressors which shall be compact, simple in construction and easily transportable for mountainous countries, or as an auxiliary plant of a mine for distant prospect work and shaft sinking, and also for tunnel work on railroads.

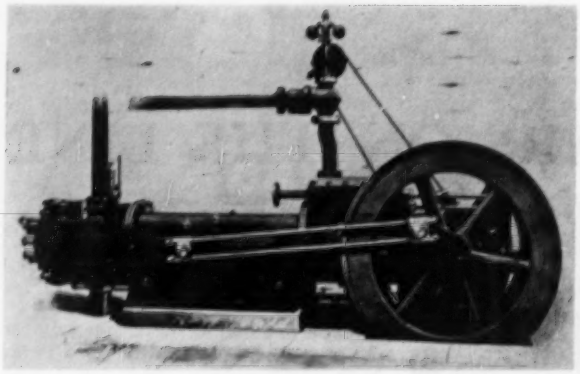
SHARING HONORS

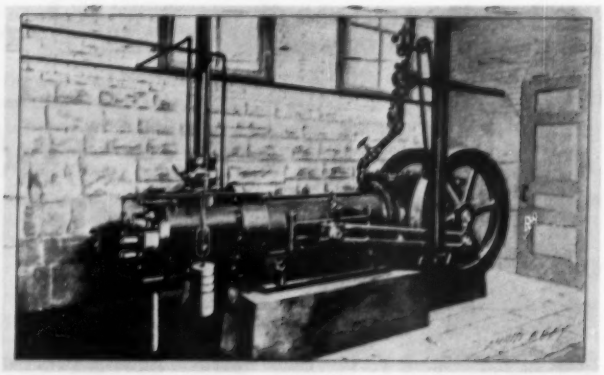
In the same building is a steam engine (below). It too was purchased in 1905. The unit powered a large planer, and has a 20-foot-diameter flywheel. Both this unit and its companion compressor have been maintained through the years by F. A. Thomas, master mechanic.



MASTER MECHANIC

Standing by the 1905 compressor is F. A. Thomas of the Foster Lumber Company. Through his efforts, not only this unit, but all of the company's equipment was kept in operation. On the machine by which he is standing, partly under the lubricator, and in raised letters are the words: THE RAND DRILL CO. The future of this compressor is unknown—it may be sold as scrap by new owners, or it may continue to serve as it has in the past.





TURN OF THE CENTURY DRAWINGS

The two illustrations above have been reproduced from a catalogue entitled "Air and Gas Compressors," published by The Rand Drill Company. They show the same type of compressor as the one that was in use in Texas. They are Class C, straight-line, steam-driven units. According to the catalogue, they are "simple in construction and easily transportable" and can be used in "mountainous countries, or as an auxiliary plant."

" . . . to get at the steam cylinders of this type of compressor the heavy fly wheels have to be removed; in our construction, the main pillow block bearings open on the end instead of on top, allowing the wheels to be *rolled out* instead of lifted out. . ." According to the same catalogue, the flywheels are 4 feet in diameter and weigh about 1000 pounds each. The over-all weight of the machine is 6800 pounds and the company stipulated a foundation of some 150 cubic feet of concrete. The machine is listed as being 11 feet 10 inches long and 2 feet 9 inches wide.

June 15 this year, the Fostoria mill was closed because of a shortage of timber; the compressor had been used almost continuously until that time. Assuming that it operated 15 hours a day (a conservative estimate, according to the owners), 365 days per year for 50 years, the machine clocked more than 270,000 hours of service.

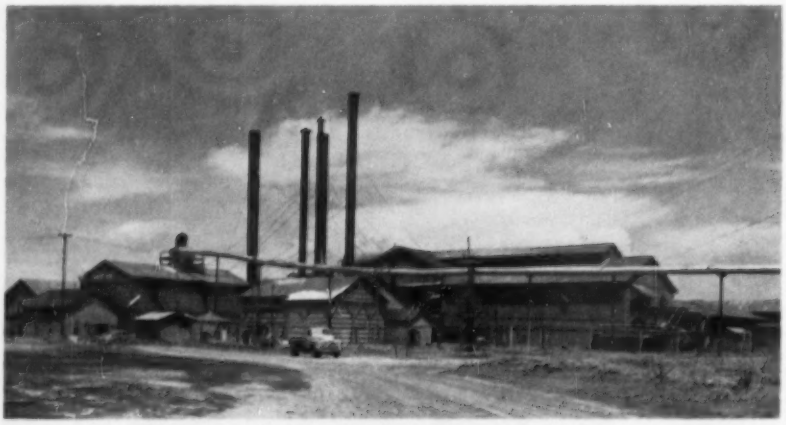
Good care is one of the chief reasons that the Rand compressor, as well as much of the other equipment in the mill, ran for more than 50 years. F. A. Thomas, master mechanic, has personally seen to its service for most of the time it has been installed. He was hired as a machinist's apprentice in 1907.

The old time compressor differs from the present day machines in that the steam cylinder is located between the flywheels. The latter are mounted on a straight shaft riding in a pillow block a few inches from the outboard head of steam cylinder. To gain the desired rigidity, the cylinder head and pillow block were made in one piece. A pair of external connecting rods join the flywheels to the cross-head. (On modern machines, the connecting rod has disappeared into the frame, being connected to a crankshaft on which the flywheels are mounted.)

In 1947, the steam head pillow block cracked so badly that it was beyond repair. A new compressor was purchased to take over the load, but Thomas was not ready to let the old machine be dismantled for scrap. Taking careful measurements of the old piece, he drew up plans for, and supervised the fabrication of, a new one of steel. It fit perfectly and has given no trouble since its installation.

Sharing the same building with the old Rand compressor, and in equally good running condition, is a steam engine, also purchased in 1905. Having a 20-foot-diameter flywheel on which rides a 20-inch flat belt, the engine powered a large planer. Thomas also takes pride in a 50-year-old machine shop—the one in which he started to work—that still is in almost perfect shape. It once was busy maintaining five locomotives as well as other pieces of heavy equipment that the Foster Lumber Company used. All the machine tools were powered through belts from a common shaft located near the ceiling. The main shaft was turned by a steam power plant located at the end of the shop. The engine was built in the Huntsville (Tex.) State Prison, also in 1905.

Until June, all of the machinery was in operation. Now only boilers and electric generators are running. Soon, they too, will be still. Foster Lumber Company has the equipment up for sale, trying to dispose of it in a "package deal." The future of the old compressor and the other machines is uncertain: whether the buyer will continue to use them, or sell them as scrap, is not yet known. Until then, they stand as mute symbols of a once thriving industry.



FUTURE UNKOWN

Here is a picture of the Foster Lumber Company of Fostoria, Tex. It was within these buildings that F.A. Thomas, master mechanic, kept his equipment in operating condition. On June 15, 1957, the mill was forced to close its doors because of a timber shortage. At the far left is the machine shop, and to its right, and just to the left of the boiler stacks, is the storage area for wood chips that were used as fuel in the boilers. The old Rand compressor was housed in the building directly behind the truck, and the saw mill was in the structure to the right of the stacks.

EDITORIAL

Materials To Order

SINCE the dawn of recorded history, man has traditionally suited an application to the materials that were available. A little recognized, but major step in our technological progress has been the development of materials to fill a given list of requirements. Not only has it played an important role in recent years, it will have more and more bearing on industry as we progress into the atomic age.

Among the initial tries at developing materials for a job, rather than applying materials at hand, were efforts to alloy metals. Nature provided few natural alloys, but it was, perhaps, a logical step for man to attempt to modify certain properties of one metal by mixing with it another. Today of course, there are a multitude of alloys, many developed specifically for a given application, then later applied to others. It is highly improbable that many of our high speed, high capacity machines, our airplanes and ships, even our motor cars, would have been developed without the corresponding growth of knowledge in metals engineering.

Until the days just preceding the Second World War, however, materials that man worked with were largely those found in nature, or adapted from naturally occuring compounds. Then came, in rapid sequence, a series of developments in an entirely new field as far as industry was concerned—the synthesis of materials not known in nature. Man's early attempts at synthesis sometimes produced materials less suitable for use than naturally occuring ones and so to the English language came a German term—*ersatz*—that frequently had the connotation of "less worthy substitute." But here and there a synthetic achieved outstanding success—Bakelite, rayon, nylon, neoprene and the like.

The new materials are bewildering in their variety; extremely dense solids and foam-like compounds, fibers, liquids, elastics and films. Some have a great deal of thermal resistance, others practically none. Some have strength that rivals older natural compounds, even exceeding that of steel. Almost all have found a place in our lives, whether in children's toys, in our automobiles or in the defense systems that guard the peace of the world. And almost all are derived by chemists, are made up of so-called giant molecules.

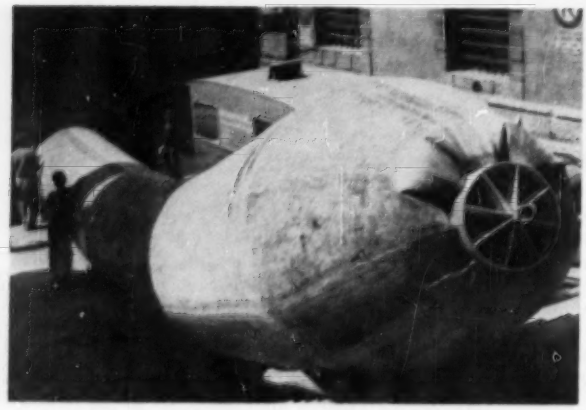
Chemists know these giant molecules as high polymers. A monomer is a simple molecule. A polymer is two or more of these monomers linked together. A high polymer is one made up of hundreds, even thousands, of monomeric units. Man has used the high polymers ever since he began to alter, even slightly, his environment. Wood is a polymer. So is silk and wool and meat and starch. Indeed, so are most organic substances thus illustrating nature's bent for complicating the processes of life.

It was in 1828 that Friedrich Wohler, a German chemist, found the key to the mystery by synthesizing in a test tube one organic compound—urea. It was not long after, that brilliant men throughout the world worked out the chemical structures of coal, fats, organic acids, petroleum, soaps and other simpler organic compounds. Their efforts gave rise to dyes, perfumes, fuels and other boons to mankind making possible the civilization that we know today and that relies so heavily on the materials of organic chemistry. Throughout their research however, scientists were plagued by reactions that, in the words of one such man, "resinified and covered my glassware with sticky messes." They termed such experiments complete failures and ignored the waxy, gluey or sticky results of their labors.

At the turn of the century however, a young Belgian scientist, L.H. Baekeland, transplanted to the United States, did not ignore a resinous mess that showed up in his test tubes. He worked with it until he found that the application of heat and pressure turned his "mess" into a hard transparent resin of excellent electrical insulating properties. His work proved most significant in the light of later developments. Others were intrigued by his success and soon after World War I, groups of scientists began a systematic attack on the mysteries of high polymers. Among those involved was W.H. Carothers of E.I. duPont de Nemours & Company. Along with a group of well trained and brilliant collaborators and backed by the resources of a giant firm that believed in basic research, he developed a thorough knowledge of polymer chemistry, synthesizing many hundreds of different giant molecules in the process. Among them were nylon and the synthetic rubber, neoprene. The research, as we all know, paid off rapidly and handsomely. Other products came along in due time, both from DuPont and from other firms.

Of the principal giant molecules now made by man, only nine elements, headed by carbon and hydrogen, are involved. The rest are oxygen, nitrogen, sulfur, chlorine, fluorine, silicon and sodium. Five of these are normally gases. Of the remainder, most are handled most easily in the form of fluids or fluid suspensions. Many of the reactions of the polymer industry involve the flow of gases or fluids through catalytic reaction chambers, the application of pressures ranging up to 30,000 to 35,000 psi or, alternatively, the lessening of pressures into the high vacuum range.

In any discussion of the credit for the rapid and beneficial developments in the making of materials to order, whether polymers or alloys, woods or glasses, rubbers or fiber fabrics we would suggest a vote for the developers of compressors and pumps that made possible laboratory work as well as large scale production.



SAVING WITH AIR POWER

BUILDING PIPELINES WITH CUCUMBERS

An unusual technique is being applied in Italy in the making of water mains and utility pipelines. Large rubber balloons, called "cucumbers," of various lengths and diameters, are laid in a ditch and inflated with air. Concrete is poured around them and allowed to harden. The cucumbers are then deflated and removed. According to the Italians, this method is more economical than that of using prefabricated pipes. The illustration at the left shows the huge size of one of these balloons.

This and That

Nickel Spike Marks Rails Completion

A gleaming nickel spike was driven into a railroad tie in northern Manitoba during late October to mark the completion of a 30-mile-long spur railway from a nickel mine to a main railroad line. The mine is to be the world's second largest producer, according to the International Nickel Company, owner of the Thompson mining area. The line, joining with the Canadian National Railways' Hudson Bay line at Sipiwesk, was pushed to completion prior to the winter freeze-up to enable Inco to ship in materials for further developmental work largely without regard to weather conditions that often affect other means of transportation in the Northland. By 1960 the Thompson mines should be producing some 75 million pounds of primary nickel. At that time Inco will have built a modern community of some 8000 population along the banks of the Burntwood River at Mansan Rapids. Nearly $175 million is being spent on the development of the mining area. It was in 1946 that the Thompson-Moak Lake region first came under scrutiny, and only a year ago that it was announced that its development was economically feasible.

* * *

Turning Guided Missiles

What makes a missile turn when it is outside the earth's atmosphere is a question that was recently answered by Leonard L. Baker, managing engineer of the mechanical laboratory at Chrysler Corporation's Missile Operations. He stated that, in space, only a few pounds of pneumatic thrust from an air nozzle is sufficient to control flight. The thrust is obtained by a high-pressure pneumatic system for storing energy—the controlled release of high-pressure gas to provide attitude control. Several advantages of such a system were offered, including such items as automatic programming, simplicity and reliability. Baker continued by noting that a pneumatic system requires a minumum of servicing and can be rapidly and simply charged. He further added that it is compatible with other materials in the system and is lightweight.

* * *

Bubble Baths For Mines

Tests will soon be underway in the United States to see if a British-developed technique for cooling mine fires can be effectively used. Foam is sprayed against a cotton net stretched across the tunnel. The bubbles thus formed make a solid wall that is carried through the tunnel by the mine's ventilating system. The foam cools the burning area and allows firefighters and rescue workers to move in close enough to extinguish the flames. The bubbles will be made of substances similar to household detergents and bubble bath powders. Although the system looks promising, it is doubtful if it can be used in any but horizontal shafts.

* * *

Alcan Route Previously Traveled

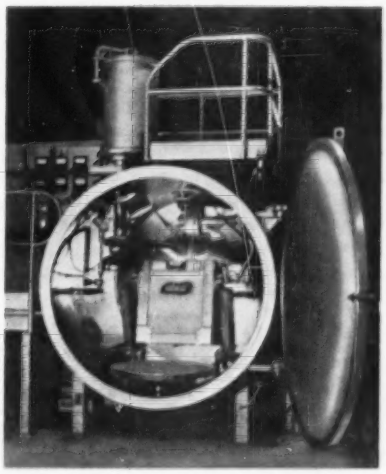
According to archaeological evidence uncovered last summer in the Southern Yukon Territory, builders of the Alaska Highway followed a migration route used by Asian tribes some 6000 to 8000 years ago. Dr. Richard S. MacNeish, chief archaeologist of the Human History Branch, National Museum of Canada, and two associates found traces of 6 different cultures in 97 camp sites during a survey of about 62,000 square miles between Dawson and Whitehorse. Objects found on 28 of the sites closely resemble those found in Outer Mongolia, suggesting that the people who used them were recent arrivals from Eastern Asia. According to Dr. MacNeish, "This material provides the strongest factual support yet for the theory that there were successive waves of migration and influence from Asia to North America."

The scientists have deduced from the camps, which were found most frequently on lake beaches, that the early North American arrivals were fishermen. Thus they appear not to be related to nine other cultures, vestiges of which Dr. MacNeish uncovered along the banks of the Firth River in the northern Yukon in 1955. The latter groups, according to interpretations of their artifacts, were largely made up of hunters and nomads. Much of the area in which this year's discoveries were made will be flooded in future years by hydroelectric schemes now under construction or considered. However, their early discovery has assured that expeditions will be able to collect most of the valuable data prior to its inundation.

* * *

Commercial Beryllium Production

First commercial production of pure beryllium—essential material in the construction of nuclear reactors—will be carried out in an induction-heated vacuum melting and refining furnace, one of the key units of a plant recently placed in operation near Hazleton, Pa., by The Beryllium Corporation. The furnace has a melting and refining crucible with a 120-pound capacity. Crude beryllium, in the form of shot, is charged into the crucible. After it has been melted and refined under high vacuum, at a pressure of about 10 microns, pure beryllium of better than 99-percent purity is poured out into ingot molds. As many as five, 13-inch-diameter, 24-inch-high molds can be accommodated on a water-cooled, rotating turntable that is 36 inches in diameter and housed within the vacuum chamber. The evacuation system for the unit con-



sists of two 10-inch oil-vapor booster pumps with a combined pumping speed of over 7000 cfm at a pressure of 10 microns. These are backed up by a rotary, mechanical vacuum pump. A large bulk additions system is provided, which works through a vacuum lock, thus permitting recharging of the crucible without breaking the vacuum inside the furnace shell. (This is the small vertical tank visible on top of the large vacuum chamber in the illustration above.) Its capacity is approximately equal to that of the crucible. A vacuum-sealed bridge-breaker, likewise working through the top of the chamber, is also provided. Induction heating of the crucible is accomplished by a 100-kw system supplied by Inductotherm Corporation. The Lummus Company was the prime contractor for the Hazleton works, and The Vacuum Equipment Division of F. J. Stokes Corporation built the furnace.

* * *

Welded Aluminum Pipeline

In Alberta's Pembine oil fields, located about 50 miles southwest of Edmonton, a 14-mile-long aluminum pipeline, as well as several miles of laterals, has been put into service. Of all-welded construction, the line carries not oil, but water. The water is being piped from the Saskatchewan River to the wellheads for injection into the ground to increase production. A conventional steel line would have involved the risk of serious contamination of the underground oil pools due to rusting of the steel pipe. Type 3S aluminum in 4- and 6-inch diameters was used, wall thicknesses being from 0.188 to 0.312 inch. The pipe was supplied by Aluminum Company of Canada and for the most part came in lengths of 40 feet. An inert gas welding process (Liquid Air Company's Argowelding) was used, argon being the shielding gas for the electric arc.

Lined Coffee Cups

There is nothing quite so distasteful as coffee that has been put in a paper cup and has absorbed the flavor of the cardboard. Dixie Cup Company has found a cure for this in a polyethylene-lined paper container. The coating is laminated to the body of the cup, and the seam is dielectrically welded. No glue is used in the construction since the polyethylene serves as a binder and strengthener. According to the company, liquids can be boiled in it without the danger of the inside lining peeling. The substance is said to have a high resistance to fats and oils, bonds evenly and has a smooth, even feel to the lips. It is hoped that eventually these cups will be on the consumer market; however, at the present, they will only be put to use in commercial vending machines.

* * *

Etching 55-Foot Tapers

What is said to be the world's largest vertical tapering tank for chemical milling is now in operation at United States Chemical Milling Corporation's Manhattan Beach Plant, Calif. The container extends 60 feet underground. More than 750 cubic yards of earth were removed during the construction. Eleven corrosion-resistant rings, 6 feet high and 12 feet in diameter, were placed in the ground to form the tank shell. The exterior of the tank was coated with a preservative before it was fabricated, and in addition, protection in the form of an anodic system was used to prevent any external electrochemical reactions from eating away the shell. Four 25-pound magnesium bars, attached around the tank, are connected electrically and grounded to provide the necessary protection. (No protection is needed for the interior of the tank since the solution used to etch the aluminum acts as a preservative for steel.)

Precise control of the immersion rate is necessary—rapid immersion produces a small taper angle and a slow rate yields a larger angle. Extrusions and other parts, up to 11 feet in diameter, are lowered by means of an overhead hoist. A continuous range of immersion speeds is available varying from 0 to 120 per minute.

* * *

Railway Signals For Mines

The Malmberget mines in Arctic Sweden are now using an all-automatic remote-control signalling device to control railroad traffic in their underground workings. Supposed to be the only one of its kind, it regulates traffic over the 1-mile-long system and is said to even correct mistakes by the dispatcher. It also reports defects in rails, cables and switches as well as reporting the presence of a train on the track. It warns other traffic in the drifts by means of closely spaced red, green or yellow lights. When the track is clear and there are no defects in the rails, the tunnel is dark. As soon as a train is put into motion, yellow lamps are lighted along its entire route, and, at the same time, green lights show that the passage is clear. As the last car in the train passes a lamp station, the yellow and green lights are shut off and replaced by the red lamp. The system was designed by Svenska Tradlos Telegrafi, Stockholm, Sweden.

* * *

Porous Shapes Of Sintered Metal Fibers

Swiftly advancing technology is causing metallurgists to take a look at a variation of an old process—powder metallurgy. The new method uses metal fibers rather than powders, and recent developments indicate the process may be the answer to a need for complex porous shapes that maintain their strength, ductility and porosity even at high temperatures.

According to Dr. Morris A. Steinberg, head of the Metallurgy Department of Horizons Incorporated, a Cleveland, Ohio, process and material research organization, "one method of preparing fibered metal shapes uses felting procedures very similar to those used in the paper-making industry. A suspension or slurry of fiber is deposited as sheet in equipment such as Fourdrinier machines. Raw material for fiber metallurgy parts is wire in fiber or filament form, produced by a wire cutting or shaving process which yields fairly continuous strands of metal. In the felting operation, a suspension of the slurry metal fiber is in contact with a porous mold or die, subjected to vacuum. The liquid is drawn away from the mold, leaving the mat of fiber on the surface. This surface can be quite complex and intricate."

Physical property variations are possible by controlling fiber length, diameter, kinking, surface roughness and

porosity. Greater strength in a predetermined direction can be achieved by preferred orientation of the fibers on the mat. For high-density parts, the felted material can be processed through rolls or dies in either single or multiple steps. As sheet, it can be processed continuously by felting, rolling, annealing and sintering.

Fiber-resin mixtures have also been tried, and are similar to processes already worked out for metal powder-resin mixes. In processing tests, commerically available fiber wools of bronze, iron, SAE 430 stainless and aluminum were used. A process involving vibration of fibers and vacuum filling of resin was found to be best.

The basic idea of the latter process is to fill a tubular die with comminuted fibers, then vibrate the fibers and add a thermoplastic resin and heat. The resin-fiber mixture is pulled through the die by vacuum.

Sintering of the mixture is conducted in a hydrogen atmosphere, the resin being volatilized and driven off below the sintering temperature. The fibers are then sintered at prescribed temperature and time as in powder metallurgy, yielding a porous filter material. Such elements reportedly have high flow rates with low pressure drops.

STAMP OF TRIBUTE

ON September 5, the Post Office Department of Canada issued a 5-cent postage stamp. Printed in black on a white ground, it illustrates a miner working with an air-powered rockdrill that was made in Sherbrooke, Que. The design was made by A. J. Casson, a Canadian artist who worked from a photograph taken by George Hunter in the United Keno Hill Mine in the Canadian Yukon. This mine is Canada's second largest silver producer, and is the fourth largest in the world. Thousands of photographs were taken and reviewed before the one reproduced on this page was selected. The artist decided to eliminate one of the workers; the one remaining has become the "Unknown Miner of Canada."

The issuing of this stamp coincided with the opening of the Sixth Commonwealth Mining and Metallurgical Congress that began on September 8, and was intended as a tribute to the mining industry in Canada. Delegates from approximately 70 countries attended the conclave and traveled from Vancouver on the west coast to Halifax in the east, visiting major mining areas and related industrial and metallurgical plants.

Since the early days when Jacques Cartier reported that he had obtained gold, silver and other valuable minerals on his trip up the St. Lawrence River; and Master Simon, an engineer who traveled with Champlain, told of discovering iron and silver at St. Mary's Bay, N. S., mineral discoveries and mining have played important roles in the development of Canada. Little need be said about the romantic gold rush days of 1896 and the value they had in pushing back western frontiers. The Yukon Gold Rush and Klondike will remain as outstanding historical events.

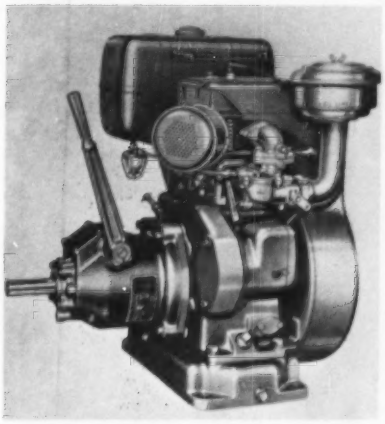
The development of the industry also had enormously beneficial effects on the economy of the country as a whole. While only 2 percent of the total labor force was directly employed in the industry in 1955, for example, countless others were, in one way or another, engaged in activities related to mining. New railroads have been built, entire population centers, towns and cities have sprung to life, and one third of all freight handled by Canadian railways consists of mine products. In addition, the mineral industry now consumes about 25 percent of all the hydroelectric power in that northern country.

To most, western oil finds and the uranium boom of recent years signify the importance of the mineral industry more vividly than anything else. While these discoveries have the greatest appeal to the imagination, recent achievements in metallurgical research and process development are of almost equal importance. The Canadian Federal Department of Mines & Technical Surveys, together with many provincial mining departments and private industry have worked as close partners in this development. Today, mining in Canada delivers products that make up more than 25 percent of its foreign trade.

UNKNOWN MINERS OF CANADA
Deep within the United Keno Hill Mine, two men were working on one of the richest faces in Canada. George Hunter, a well known mining photographer, took their picture (right) and submitted it, in competition with thousands of others, for review. It was selected, and used by A. J. Casson, a Canadian artist, as the model for a stamp (above). The miners in the original are using a DA-35 power feed drifter that was manufactured by Canadian Ingersoll-Rand Company, Ltd., in its Sherbrooke, Que., facility.

Industrial Notes

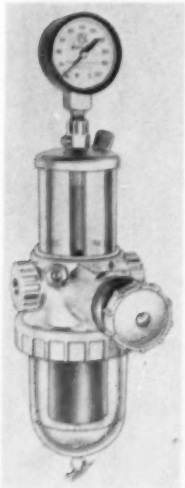
For applications requiring heavy-duty air-cooled engines, Wisconsin Motor Company has announced a 4-cycle, single-cylinder engine, Model AGN. Rated at 12½ hp, the unit has a speed range of from 1600 to 3200 rpm, and a piston displacement of 38.5 cubic inches. According to the manufacturer, the basic high torque of the machine provides the load-holding lugging power that resists



revolutions-per-minute slowdowns under sudden shock loads, thus preventing stalling and permitting quick power recovery. Fall delivery is scheduled, but fully illustrated descriptions of the motor are currently available in Bulletin S-216.

Circle 1E on reply card

As a complete package unit for compressed-air operations, Perfecting Service Company's regulator-filter-lubricator



performs all three operations simultaneously. It is ready to install and requires only two connections. The regulator operates on a balanced piston principle. Large seats and seals are said to maintain accurate adjustment. Automatic bleed-off permits sensitive pressure reduction without bleeding the down-stream line. Cyclonic action within the filter bowl removes dirt and water. A second filtering takes place as the air passes through an inexpensive, throw-away-type cartridge that may be easily replaced without either the use of tools or removing the filter from the line. External oil adjustment meters the lubricant, which automatically enters the air stream as an oil mist. A special filler button valve permits the refilling of the oil reservoir without stopping operations or shutting off the air supply. The device is available in ¼-, ⅜-, ½- and ¾-inch pipe sizes.

Circle 2E on reply card

A portable air and/or oxygen mask and resuscitator unit that provides equal protection to rescuers and asphyxiation victims has been introduced by The Fyr-Fyter Company. Known as the Dualife and weighing only 39 pounds, the unit contains 52 cubic feet of gas in its two chromaloy cylinders, enough for about 40 minutes of use as a combination or about an hour's service individually. Two small cylinders are used, rather than one larger one, to improve balance and increase maneuverability in narrow spaces. The resuscitator valve and facepiece are carried in a canvas pouch on a belt strap and attached to the regulator by a quick-connect-disconnect coupling as is the mask valve. Built-in gauges provide the wearer with accurate pressure information, and a warning bell sounds automatically when the compressed air or oxygen supply needs replenishing. The unit may be used as a resuscitator alone in such cases as drowning, electric shock, and the like. A demand valve, mounted in the mask's facepiece, and a Seeler valve in the resuscitator are said to assure dependable, efficient operation. The nylon harness is fitted with "quick adjust" clamps for fast and comfortable positioning.

Circle 3E on reply card

To reduce objectionable noise from air exhausts without noticeably impairing the efficiency of air-operated equipment by building up back pressure, Air-Maze

Corporation has developed a compact silencer. Known as the Muffl-Maze, the unit is a self-contained assembly having standard pipe threads that mounts directly on any discharge port or piping. It is applicable to all types of air and vacuum devices such as pneumatic chucks and holding mechanisms, feeders, air motors, actuators, hoists and the like. Because the filtering media is completely metal, the entire assembly can be cleaned in any commercial solvent. Standard sizes are available for ⅛-, ¼-, ⅜-, ½- and ¾-inch pipe.

Circle 4E on reply card

For precision jacking, pushing and pulling operations, and linear actuation, The Joyce-Crid and Company has designed a worm-gear screw jack. The unit, illustrated below, has a 15-ton

capacity. The housing is 8⅞ inches long; and the worm-gear ratio is 8 to 1, with 32 revolutions of the worm giving 1 inch of travel. Power sources can be either manual or mechanical. Four-way miter box assemblies are available for multiple systems requiring synchronization. Applications for this equipment include machine adjustment, vertical adjustment of rolls or other machine members, loading platform and feed-table adjustments, raising and lowering of all kinds of production equipment, and stabilizing and leveling mobile units. Jacks can also be designed, according to the manufacturer, into equipment to provide impact resistance, maintain precise leveling or expedite servicing on overhead cranes and other equipment.

Circle 5E on reply card

OTR is the designation of Dollinger Corporation's Off-the-Road filter that should be of interest to men in the con-

What are Your
PIPING NEEDS?

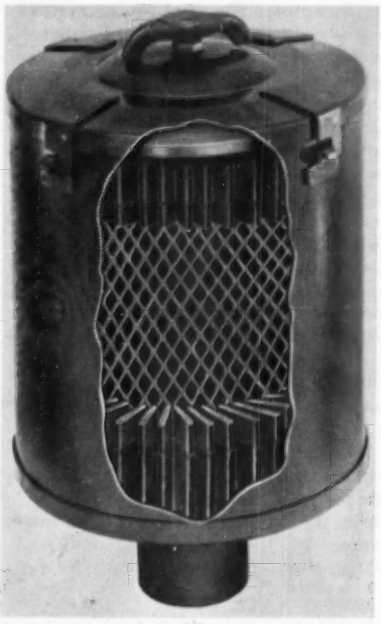
Ventilating? High-pressure air? Water? Drainage? Dredging? It will pay you to look into the performance advantages of NAYLOR Spiralweld pipe for services like these. Ease of handling and installation. Extra strength and safety. Speed and economy of connection with the one-piece NAYLOR Wedgelock coupling. Sizes from 4″ to 30″ in diameter; thickness from 14 to 8 gauge. Write for Bulletin No. 507.

NAYLOR

NAYLOR PIPE COMPANY
1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office:
60 East 42nd Street, New York 17, N. Y.

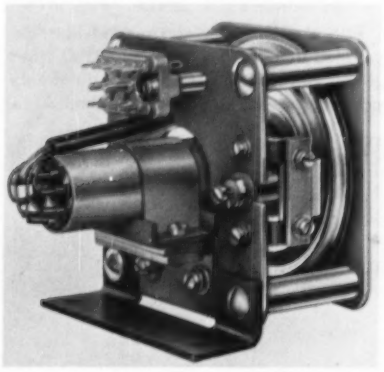
struction industry. It is an intake air filter that is used as a precleaner for use in conjunction with oil bath filters on diesel and gasoline engines of heavy mobile or stationary equipment. It



utilizes a dry-type medium, Feltex 40, that is claimed to be 99.7-percent efficient in stopping dirt that would pass through conventional oil bath cleaners to rings, pistons and cylinder walls of engines in such equipment as scrapers, bulldozers and trucks. Cleaning of the filter is accomplished easily by merely blowing it off with compressed air at a pressure of 70 psi.

Circle 6E on reply card

Fischer & Porter Company has designed a pressure transducer for use in data reduction systems. It converts a 3- to 15-psi signal to alternating-current



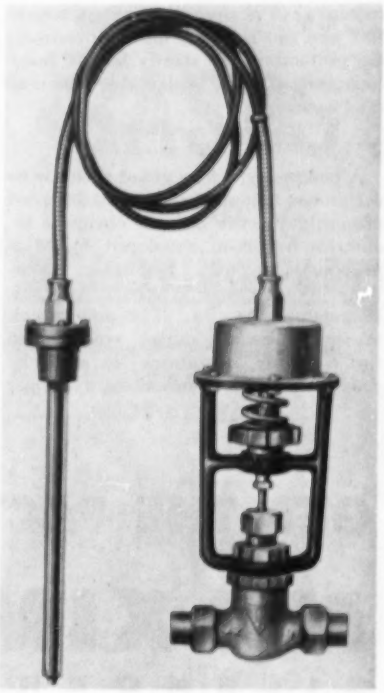
millivolts in direct proportion to the pneumatic input. When pressure is applied to the sensing element of the transducer, the resulting movement of an expandable capsule displaces an armature that induces opposing voltages in twin secondary coils. This voltage is linearly proportional to the pressure input. The output may be used to position an indicator, recorder or control device. Reportedly accuracy of the device is 25 percent of the full scale.

Circle 7E on reply card

For quick determination of correct grinding wheel speeds, Simonds-Worden-White Company has prepared a handy, pocket-sized selector. This finger-tip, slide-type chart will not only determine wheel revolutions per minute, but will also point out correct wheel diameters in inches or surface speed in feet per minute. A reference table on the back shows the speeds recommended for each of the standard varieties and shapes of grinding wheels.

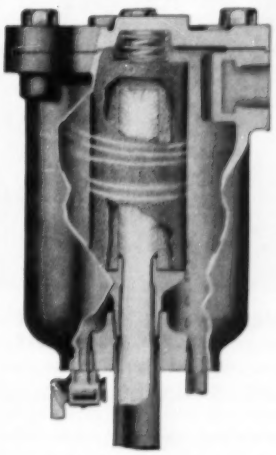
Circle 8E on reply card

Watts Regulator Company has designed an accurate line of single-seated temperature regulators for automatic flow control of liquids or steam. These self-operating devices are of two types: direct and reverse acting. The former (155 Series) maintains the liquid temperature by controlling the heating source, such as steam. They are available in ½- to 1½-inch sizes. The latter type (157 Series) maintains the liquid temperature by regulating the cooling source, such as water. They are available in ½- to 1-inch models. Both are reportedly easily adjusted for temperature control



ADAMS PORO-STONE AIR FILTER

designed to remove oil, water and foreign matter from compressed air lines with minimum pressure drop.



The R. P. Adams Poro-Stone air filter is engineered to efficiently remove entrained oil, water and pipe scale from compressed air lines. Liquid droplets and solids being carried by the gas stream are first removed by centrifugal action in an annular chamber. Secondary filtration is achieved by passing the air or gas stream through a Poro-stone unit. An automatic trap can be provided to discharge the residue from the cyclone chamber.

At rated capacity the filters operate at a maximum pressure drop of only ½ lb., thus insuring delivery of line pressure to the point of consumption.

The units require virtually no service or maintenance — thereby insuring continued trouble-free, low cost performance.

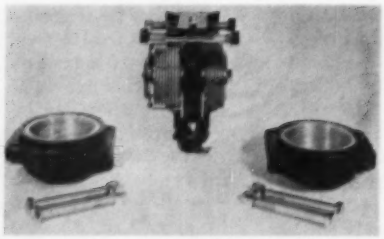
ADAMS Poro-Stone air filters are available from stock in sizes to suit your needs. For further information, write today for Bulletin 117, R. P. Adams Co., Inc., 209 East Park Drive, Buffalo 17, New York.

Circle 13A on reply card

within a 40°F operating range within 100° and 240°F. They feature overheating protection and sturdy bronze body construction with replaceable stainless steel seats.

Circle 9E on reply card

A bellows-type flow meter accurate to within one-half of 1 percent and designed primarily for the oil and chemical industries has been developed by Minneapolis-Honeywell Regulator Company, Wayne and Windrim Avenues, Philadelphia 44, Pa. The differential-pressure measuring device, according to the company, maintains its accuracy even when ambient temperature changes



by as much as 100°F and static pressure reaches 2500 psi. Range of the flow meter is easily changed in the field, it is reported, by springs available in 15 different ranges between 0-20 and 0-400 inches of water.

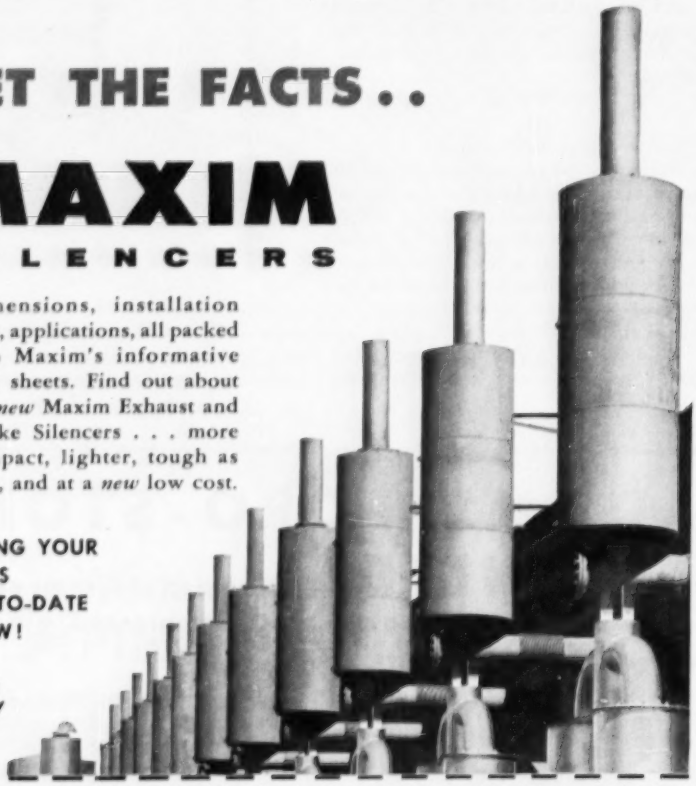
GET THE FACTS . .

MAXIM

SILENCERS

Dimensions, installation data, applications, all packed into Maxim's informative data sheets. Find out about the *new* Maxim Exhaust and Intake Silencers . . . more compact, lighter, tough as ever, and at a *new* low cost.

BRING YOUR FILES UP-TO-DATE NOW!



THE MAXIM SILENCER COMPANY

Subsidiary of Emhart Manufacturing Company

61 Homestead Ave., Hartford, Conn.

Gentlemen: Please send bulletins on silencers for: ☐ WASTE HEAT RECOVERY

☐ INTERNAL COMBUSTION AND STEAM ENGINE EXHAUST AND INTAKE ☐ AIR COMPRESSOR INTAKES AND DISCHARGES ☐ VACUUM PUMP DISCHARGES

☐ BLOWER INTAKES AND DISCHARGES ☐ STEAM, AIR OR GAS DISCHARGES ☐ JET AIRPLANE ENGINE EXHAUST AND INTAKE

NAME _____

COMPANY _____

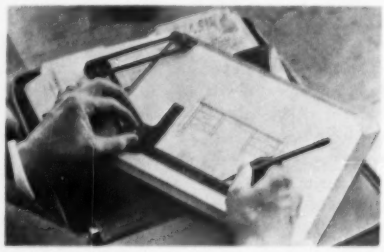
ADDRESS _____

Circle 14A on reply card

Triethylammonium Phosphate 802 is an effective corrosion inhibitor at low concentration and is suggested as an additive in closed pipe systems where water, glycerine, alcohol or glycol are used, and where corrosion is a problem, as in automobiles, hot water systems, industrial cooling systems, tractors, road-building machinery, marine engines, oil-drilling rigs, and airplanes and in heating coils for concrete roads and driveways. It is of particular interest as an ingredient of formulations where water, alcohol, glycol and glycerine in combinations with other materials are stored in tin-plated and steel containers where longer storage life is desirable, or as an ingredient of water soluble corrosion inhibitors, specialty detergents, emulsion paints, and paint removers. Beacon Chemical Industries, Inc., the manufacturer, packs this product in 5-, 30- and 55-gallon drums as well as tank cars.

Circle 10E on reply card

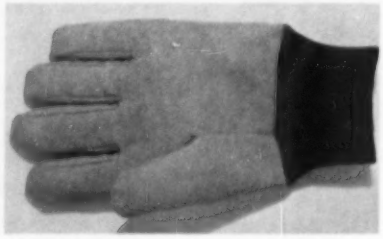
A portable drafting machine that is said to be so compact that it can be folded to fit in the pocket when detached from its drawing board has been introduced by David Miller & Associates. Of all aluminum construction the Draft-



ette, as it is called, has an anodized jet-black finish with white-filled numbers and markings. It reputedly takes the place of T-square, ruler, protractor and triangles. It is available in sizes for drafting boards measuring 10x13, 11x17 and 20x26 inches.

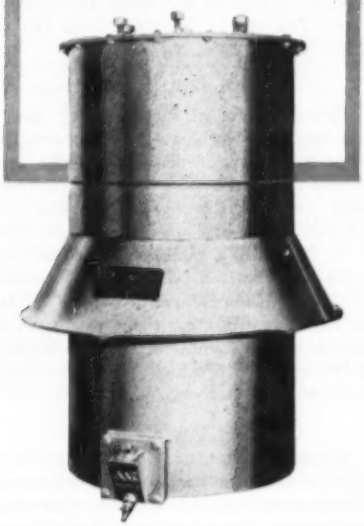
Circle 11E on reply card

Riegel Textile Corporation has developed a new fabric for industrial work gloves that consists of tiny plastic dots embedded in cloth. The



gloves thus made are said to outlast and "outgrip" other long-wearing gloves and to cost from $0.17 to $0.41 per pair less than other types. The fabric is light-

AAF Cycoil Oil Bath Air Cleaners Give Positive Protection



AAF Type "W" Cycoils have proved themselves in thousands of installations—even where dust conditions were most severe. High collection efficiency and virtually maintenance-free operation have made Type "W" Cycoils favorites in all industries.

The operation of the Cycoil is unique. A combination of oil impingement, centrifugal action, and filtration results in practically 100% dust removal in standard A.S.H.V.E. tests.

Would you like more information? Write for our illustrated catalog.

American Air Filter
COMPANY, INC.
402 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.
Circle 15A on reply card

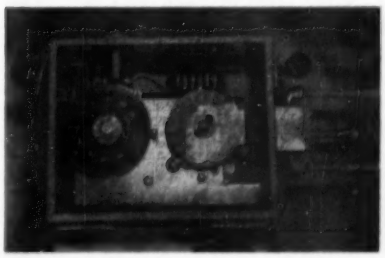
weight and flexible, and "breathes" between the dots, ending perspiration problems. *Circle 12E on reply card*

For heavy-duty work where external abrasion on air hoses is a problem, and yet where maximum flexibility and lightweight are important, Acme-Hamilton Manufacturing Corporation has developed a line of wire-braided hose that reportedly will withstand working pres-

sures as great as 1500 psi. Known as Acme Gold Seal, the tubing is designed for use on compressors, wagon drills and jumbos in tunneling, quarrying, coal mining and road building applications. It consists of a thick neoprene tube, 1- or 2- strand wire braid and an abrasion-resistant, hard-rubber covering. The hose is available in ½ to 2½-inch inside-diameter sizes.

Circle 13E on reply card

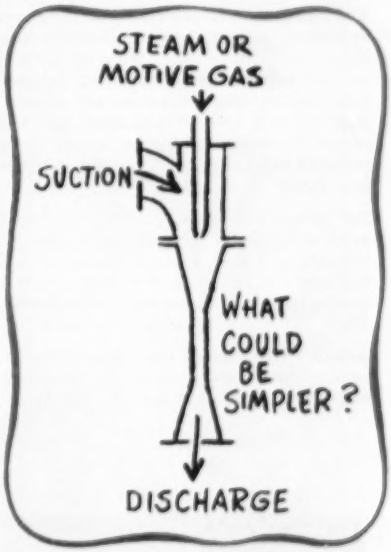
Seely Instrument Company, Inc., has developed a combination cam timer and an interval timer in one compact unit. Called Integral Button Controller, Model IBC-2, the device is reportedly applicable to a wide field of flexible-cycle control situations without the use of relays. Designed primarily for control operations related to compression molding industries, the IBC-2 bridges the area between the point at which a plain



interval timer or a single-cam timer suffices and that where a high degree of cycle complexity justifies more expensive equipment. In combining the elements of the cam timer and the interval timer, the unit provides flexible-cycle control at reasonable cost, and at the same time overcomes many limitations enountered when cam and interval timers are used separately.

Circle 14E on reply card

how to move GASES with NO MOVING PARTS



In I-R Ejectors, nothing moves but the motive and suction gases

AS SIMPLE and sturdy as a piece of pipe, the I-R Ejector offers real *economy* and *dependability* for a wide range of applications.

They can be used to create vacuum or increase pressure, and to mix gases.

Your nearest Ingersoll-Rand branch office or representative will be glad to give you complete information.—Or write today for a copy of Bulletin 9013-A.

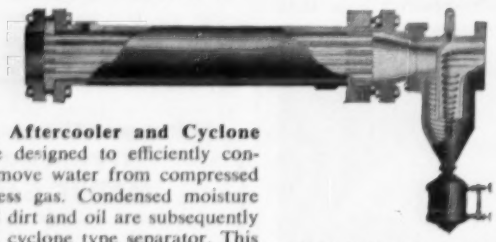
Ingersoll-Rand
11 Broadway, New York 4, N. Y.

4-659

Circle 16A on reply card

Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.
209 East Park Drive, Buffalo 17, New York



The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm where it is necessary to cool within 2°F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

Circle 17A on reply card

NON-FLUID OIL
TRADE MARK REGISTERED

PEP UP YOUR AIR TOOLS ON THE JOB

Just pour A-88-NR NON-FLUID OIL in back end of any air tool. Hook up air line again and start to work. Within seconds any operator will notice a marked increase in speed and power.

Use it regularly and your tools will **remain on the job at top efficiency.**

Let us send you a free testing sample and Bulletin 550 used and approved by practically all tool manufacturers.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
292 MADISON AVE., NEW YORK 17, N. Y.
WORKS: NEWARK, N. J.

WAREHOUSES

Birmingham, Ala.		Greensboro, N. C.
Atlanta, Ga.	Greenville, S. C.	Detroit, Mich.
Columbus, Ga.	Chicago, Ill.	Providence, R. I.
Charlotte, N. C.	Springfield, Mass.	St. Louis, Mo.

1896 61 1957 YEARS OF LUBRICATION SERVICE NON-FLUID OIL TO INDUSTRY

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 18A on reply card

BRIEFS

Electronic Fiber Fineness Indicator (EFFI) is a desk-sized unit that rapidly scans the diameters of fibers contained on sample slides, and computes the average diameter of the sample and the percentage of fibers whose diameters are within selected distribution groups. Its operation is automatic and responses appear on direct reading counters. According to Fiber Research Corporation, the designer of the system, results obtained are rapid, accurate and independent of human judgment, even though only semiskilled technicians are required to operate the unit.

What is believed to be the world's longest conveyor belt shipped in one piece was recently loaded on a special lo-bed gondola at the Passaic, N.J., plant of the Manhattan Rubber Division of Raybestos-Manhattan, Inc. The belt is 2940 feet long and is slated for use in a coal mine.

Development of high-density polyethylenes having great tensile strength, temperature resistance and rigidity has resulted in an improvement of properties that have startling results from the standpoint of structural fabrication. Dr. J. A. Newmann, president of American Agile Corporation, states that "tensile strength of the new polyethylenes can be as high as 6000 psi, compared with a maximum of 2000 psi for low-density polyethylenes produced by previous, conventional methods."

Kitchener, Ont., police have an idea that the color of vehicles may somehow affect the motor car accident rate. According to a survey now under way, light gray or sand-colored cars get hit more often, and only one red car has been involved in an accident in their jurisdiction.

Hanna Engineering Works has earned its fourth consecutive National Safety Council Award for completing a year without a disabling accident. The fourth-year award represents a total of 2,211,-988 man-hours worked without a lost-time accident. Hanna won its award in the heavy machinery classification. Among the firms competing, 172 perfect records were announced and a total of nearly 3¼ billion safe man-hours were worked.

According to a report of University of Chicago astronomer Gerard P. Kuiper, the rings around Saturn are made of snow. Kuiper made his discovery with his infrared spectrometer. The instrument was

developed 11 years ago and uses a dime-sized vacuum tube that is ultrasensitive to infrared rays. The instrument also detected snow on two of Jupiter's nine moons and confirmed the presence of carbon dioxide in the Martian atmosphere.

Using colored epoxy resins, rather than conventional paints and brushes, what is reported to be the world's largest mural is being made on stainless steel in a branch of The Chase Manhattan Bank. Electric drills and sanders were used to burnish and line the unpainted parts. Buell Mullen is the artist, and her 51x14-foot work represents an impressionistic view of industry and finance.

A bronze bust of George Westinghouse, inventor, engineer and manufacturer, has been fashioned by Edmondo Quattrocchi for New York University's Hall of Fame. Westinghouse was elected to the shrine in 1955, and the statue, a gift of the American Society of Mechanical Engineers, was unveiled at the Hall on December 1.

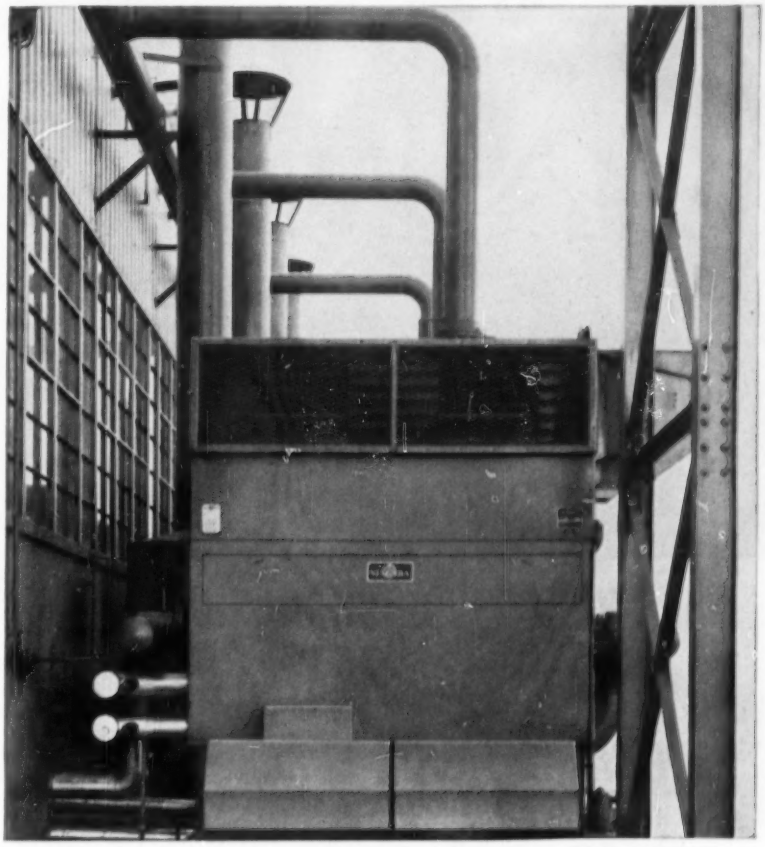
Amateur photographers and sightseers will be interested to hear that Grand Coulee Dam is being "dressed up." About 750 1500-w floodlights will throw alternating beams of red, green, blue and amber light on the 550-foot structure. Focal point will be the waterfall over the central spillway, a point at which the overflowing water is twice as wide, and drops twice the distance, as that at Niagara Falls.

Flick-Reedy Corporation's Chicago, Ill., plant has recently installed a heat pump that is said to be the largest of its type in the United States. According to reports it will evacuate about 250,000 cubic feet of winter air every minute. The device will cool the 220,000-square-foot plant in summer by reversing the mechanism.

Individuals helping to test atomic weapons face "considerably less danger" than the average automobile driver or pedestrian crossing a busy street, according to a speaker at the Semi-Annual Meeting of The American Society of Mechanical Engineers.

Phase changes in metals are being observed at temperatures of about 2000°F with the aid of a vacuum hot-stage metallograph. The instrument, located at Armour Research Foundation of Illinois Institute of Technology, is basically a closed chamber containing a tungsten-wound furnace that is sealed to provide a vacuum, and a photo-microscope.

HOW YOU SAVE . . .
Getting Drier Compressed Air



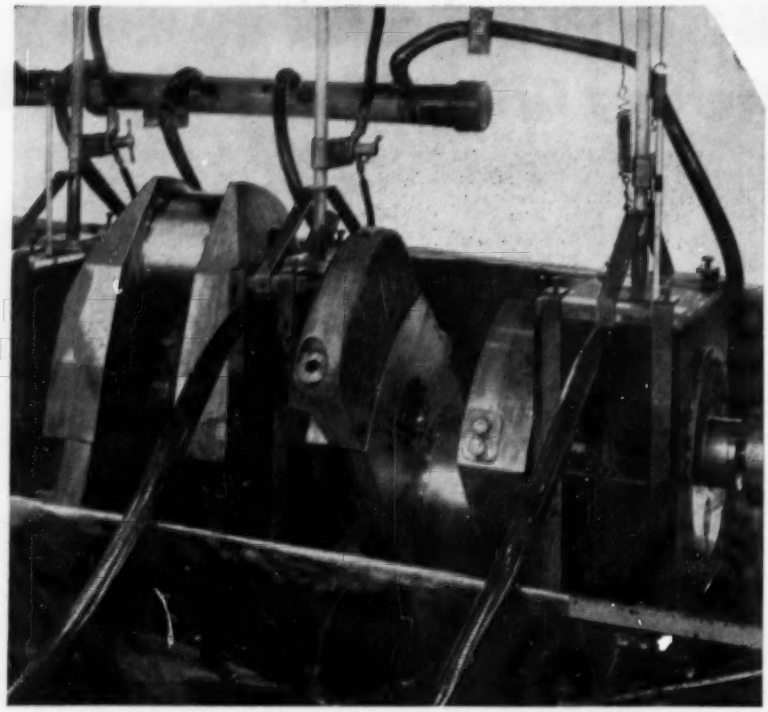
Save the cost of Cooling Water and you save the price of the NIAGARA AERO AFTER COOLER (for compressed air or gas) in less than two years.

● Extra, for no cost, you get drier compressed gas or air for your process. You get better operation and lower costs in the use of all air-operated instruments, machines, or paint sprays. You save expense for piping, pumping, water treatment and disposal. You get the use of badly needed water elsewhere in your plant.

Niagara Aero After Cooler cools compressed air or gas (evaporatively) below the temperature of surrounding atmosphere, with no further condensation in your air lines.

Write for complete information; ask for Bulletin 130, or contact nearest Niagara Engineer if you have any problem involving the industrial use of air.

NIAGARA BLOWER COMPANY
Dept. CA-12, 405 Lexington Ave. New York 17, N. Y.
Niagara District Engineers in Principal Cities of U. S. and Canada
Circle 19A on reply card

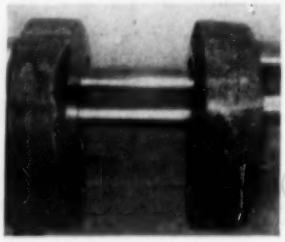


THIS REBUILT CRANKSHAFT IS CHROMIUM PLATED BY A SPECIAL NATIONAL FORGE PROCESS

When your crankshaft is reconditioned at National Forge, here's how it is chrome plated. Each bearing surface is individually boxed and plate thickness is built up only as required. Different thicknesses—over ⅛" if needed—can be added to different surfaces of the same crank. Because only the boxed surfaces are exposed to plating action the fillet areas retain their original strength.

When applied by National Forge specialists, chrome plating is uniform and smooth. Regrinding is kept to a minimum and your reconditioned crankshafts are returned to you meeting the original shaft's specifications.

No other plating company has National Forge's experience in handling both new and rebuilt crankshafts. So why not try National Forge specialists on your crankshaft rebuilding jobs?



This is a finished, repaired crankshaft after processing by National Forge.

For more details on crankshaft repair, write for Bulletin RC-4.

NATIONAL FORGE
AND ORDNANCE COMPANY
IRVINE, WARREN COUNTY, PA.

Circle 20A on reply card

Adv. 22 (390)

Industrial Literature

How welded polyethylene ducting systems have provided the answer to corrosion in the handling of alkali and acid fumes, is the subject of a folder released by the American Agile Corporation. Cost reductions made possible by a polyethylene system that includes ducting and fittings, centrifugal fans, and the like are detailed. Photographs show the installation in operation as well as details of the major components. In addition, two charts give pertinent data on properties of structural grade polyethylene and specifications of seamless centrifugally cast ducting.

Circle 15E on reply card

Three Oxweld welding blowpipes are described in a 6-page folder (Form No. 1007) made available by Linde Company, a Division of Union Carbide Corporation. It is said that low-pressure operation makes it possible to use the three units at acetylene pressures of less than 1 psi. Attachments that quickly convert these blowpipes from welding to flame-cutting operations on all thicknesses of metal up to 8 inches are also described, as well as information and performance data on welding heads and cutting nozzles.

Circle 16E on reply card

Product Research and Development has been published by the Franklin Institute Laboratories, 20th and Parkway, Philadelphia 3, Pa. Under "Product Planning and Design," "Materials," "Production" and "Processes," the 20-page brochure lists specific areas in which the Laboratories is staffed and equipped to perform research and development. Projects completed and underway are mentioned to illustrate the extent of the services available. A letter on company letterhead to the Manager, Information Services, will bring this booklet free of charge.

Breaking Lubrication Barriers is a 16-page brochure that covers the history and development of the Alpha Molykote Corporation's line of molybdenum disulphide lubricants. It describes the substance as an extreme pressure lubricant and includes its physical and chemical properties. Featured in the booklet are a catalogue-type selection table, photographs showing a variety of uses and a section on bonded solid-film lubricating coatings. Copies may be obtained free of charge by writing on letterhead to the company at 65 Harvard Avenue, Stamford, Connecticut.

Home Tumbles Are No Circus pokes fun, but with a serious purpose, at the would-be home repair man, the lady who can't see over the top of a load and the

fellow who gropes in the dark. *Your 10 Best Tools* is an 8-page pamphlet about the value of hands and fingers in work. Splinters, careless use of equipment, machinery and solvents and similar carelessnesses are potential destroyers of the ten fingers. Both are illustrated with cartoons. Sample copies and prices for quantity orders may be obtained directly from the National Safety Council, 425 North Michigan Avenue, Chicago 11, Ill.

Wet Blast Cleaning and Finishing News, a periodical of Wheelabrator Corporation, discusses and illustrates many applications of Liquamatte, a wet blasting machine, in both metal cleaning and finishing operations. Although the most commonly used wet blast abrasive is a silica-type slurry, many other abrasives are available for special applications. Some of these are described in the illustrated magazine.

Circle 17E on reply card

Producers of powdered metal parts can take advantage of Hoeganaes Sponge Iron Corporation's free production testing service, according to the company. The service offers a coöperative effort between powder producers and metal parts manufacturers to arrive at proven raw-material-mix specifications. Form No. 108 details all steps of this quality-control production service.

Circle 18E on reply card

A 16-page bulletin (No. 7C) illustrating and describing Wm. W. Nugent & Company, Inc.'s laminated fiber disk filters provides information on the design, construction, specifications and capacities of standard, high-pressure and duplex models. Also included are special purpose assemblies, accessories and installation data.

Circle 19E on reply card

A 72-page illustrated catalogue describing a complete line of CF & I-Wick-wire wire has been made available by The Colorado Fuel & Iron Corporation. Included are diagrams and descriptions of the various types and grades of wire, such as flat shaped, low-carbon coarse and fine, high-carbon fine and specialty wire. *Circle 20E on reply card*

Rotaircool is a pellet cooler and dryer designed for small and medium pellet production requirements. Designed by Sprout-Waldron & Company, Inc., the unit is described as to its construction, operation and installation in Bulletin No. 177, a 4-page illustrated flyer that has recently been published.

Circle 21E on reply card

For personnel concerned with roof maintenance, *Solving Roof Problems*, a 16-page brochure released by The Tremco Manufacturing Company, provides

Teamed for DEPENDABILITY

BLAW-KNOX MODEL 85 ROAD WIDENER AT WORK NEAR KNOXVILLE, TENNESSEE. POWER: CONTINENTAL RED SEAL.

...two Famous Names: Continental and Blaw-Knox

Like so many other leading builders of construction machinery, Blaw-Knox offers its customers the tangible PLUS-value of Continental power. Continental engineers each power plant to the specialized requirements of its job, for highest dependability, longest trouble-free life.

WORLD'S LEADING INDEPENDENT MANUFACTURER OF INTERNAL COMBUSTION ENGINES, CONTINENTAL MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT, MILWAUKEE, MUSKEGON, AND TOLEDO, AND IN ST. THOMAS, ONT., PRODUCING AIR-COOLED AND LIQUID-COOLED ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

Continental Motors Corporation

MUSKEGON • MICHIGAN

FACTORY-AUTHORIZED SERVICE AND GENUINE RED SEAL PARTS ARE AVAILABLE EVERYWHERE

Circle 21A on reply card

for pumping

ECONOMY

you need

MOTOR PUMP quality

Here's the major point to keep in mind the next time you're ready to order centrifugal pumps . . . year after year the quality of I-R Motorpumps continues to pay off in actual savings through reduced maintenance costs, uninterrupted service and maximum pumping efficiency.

You can always choose the right pump from the wide range of Ingersoll-Rand Motorpump types and sizes, and be sure of modern design features that assure rugged dependability.

Complete information on I-R Motorpumps is available from your nearby Ingersoll-Rand branch office. Or write for latest bulletin.

MOTOR PUMP
by
Ingersoll-Rand
11 Broadway, New York 4, N.Y.

9-671

Circle 22A on reply card

an authoritative discussion. Illustrated by photographs, drawings and diagrams, the publication explores such subjects as the various types of roofs, how they are built, what factors enter into their deterioration, and how troubles can be diagnosed and treated.

Circle 22E on reply card

To locate the hidden probabilities of electrically ignited explosions in plants, a *Hazard Finder* is being made available by Crouse Hinds Company, Wolf & Seventh North Streets, Syracuse, N. Y. An 8-page, illustrated folder, it contains a check list of thirteen questions that can help to determine whether uncontrolled flammable gases, vapors, dusts, liquids and other combustible materials are making unsafe plant conditions. Copies may be obtained directly from the firm by writing on company letterhead.

Wear-Resist liners that are said to give better protection of blast cleaner parts subject to abrasive action are described in Bulletin No. 332-B, issued by Pangborn Corporation. Application information and specification data for both Rotoblast wheels and Pangborn Blastmasters are given, as are statements about two diamond-hard alloys available for wheel housings, drum heads and other blast-cleaner parts.

Circle 23E on reply card

Raw materials used in producing V-belts are covered in a booklet issued by the Goodyear Tire & Rubber Company. Natural and synthetic rubbers, cotton and synthetic cords, rubber chemicals and steel cables are subjects of 1-page explanations.

Circle 24E on reply card

Surface Treatment of Metals is an 84-page booklet describing the latest developments in the field. Available from E. F. Houghton & Company, the handbook covers rust prevention, mechanical and chemical cleaning, blackening, phosphating and other aspects.

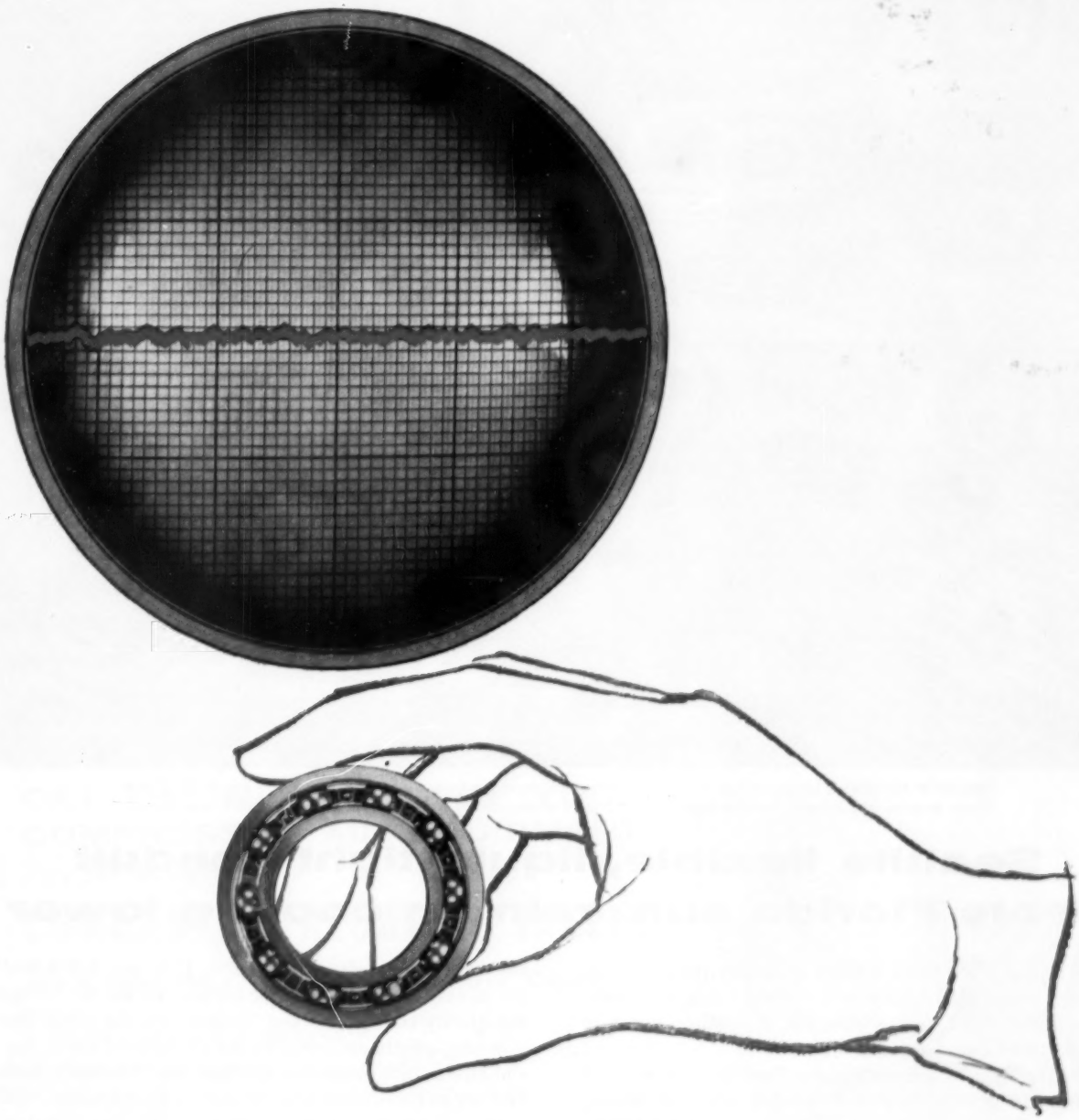
Circle 25E on reply card

Technical Literature on Castings, an 8-page folder, has been released by the Gray Iron Founders' Society. It describes the contents of fifteen Society publications dealing with the selection, purchasing, design and fabrication of gray iron castings.

Circle 26E on reply card

Pneumatic conveyor systems for transporting bulk granular materials are described in an 8-page bulletin published by The Brady Conveyors Corporation. Air requirements are reportedly low and can generally be supplied from existing plant air compressors.

Circle 27E on reply card



SCIENTIFIC "SOUNDINGS" PRODUCE QUIET BEARINGS

Through the application of the latest electronic instruments, SKF research engineers have been able to further reduce the sound factor in anti-friction bearings. SKF provides the quietest running, rolling contact bearing in the world of today... at no added cost.

Other recent laboratory achievements include improvements in sealing and increase in bearing operating life, further assuring users the best bearings for their dollar. But accept no substitutes – you benefit from these only when you insist upon SKF. 7793

SKF®

EVERY TYPE—EVERY USE

Spherical, Cylindrical, Ball, and "Tyson" Tapered Roller Bearings*

*Reg. U.S. Pat. Off.

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

Circle 23A on reply card

TWO-INCH SEALTITE is connected to 60 H.P. motors used to drive fans on cooling tower at Gainesville Power Plant. Sealtite was selected for this installation because a completely weatherproof flexible conduit was needed.

Sealtite flexible, liquid-tight conduit beats Florida sun, rain on cooling tower

The Sealtite* electrical conduit shown above is used to protect motor lead wiring on a cooling tower at Gainesville Power Plant, Gainesville, Fla. It's fully exposed to the weather – year around.

But tough jobs are routine for Sealtite – the original liquid-tight flexible conduit. Wherever vibration, flexing, wet or corrosive operating conditions or space limitations pose a tough conduit problem, Sealtite more than pays for itself. Installed in far less time than it takes to bend and fit rigid conduit, it often outlasts metal conduit. Its tough extruded polyvinyl jacket keeps out moisture, oil, chemicals.

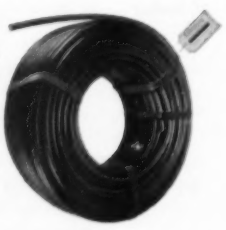
Electrical Wholesalers stock Types U.A. and E.F.† Sealtite in easy-to-handle coils. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Special liquid-tight connectors by Appleton, Thomas & Betts, Gedney or Pyle-National are available. Free Booklet S-537 gives full information on Sealtite. Write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Sealtite is approved by Canadians Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ont. 57188

*Trademark
†Pat. Applied For

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

Insist on the conduit marked

SEALTITE



flexible, liquid-tight conduit

an ANACONDA® product

Complete information on pump design and application . . .

NEW SECOND EDITION

CENTRIFUGAL AND AXIAL FLOW PUMPS

By A. J. Stepanoff
Development Engineer
Ingersoll-Rand Company

Keeps pace with progress . . .

Revised and expanded to reflect the significant advances in recent years in the field of centrifugal pumps, this book provides a modern treatment of the whole field. Includes a method of attack based on: a single pattern of flow; identical theoretical reasoning; and similar design procedure for centrifugal, mixed flow, and axail flow pumps.

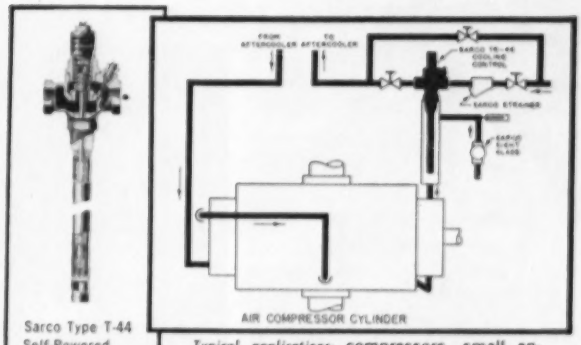
Features of the 2nd edition . . .

- New material on centrifugal-jet pump systems
- Important design elements and performance characteristics incorporated in a single chart covering all important design elements
- Chapter on water-hammer problems
- A Concise account of progress in water storage pumps
- New charts relating to impeller design for any discharge angle
- . . . and many others

1957. 462 pages. $12.00

For Sale By:

COMPRESSED AIR MAGAZINE
942 Memorial Parkway, Phillipsburg, N. J.



Sarco Type T-44 Self-Powered Cooling Control

Typical applications: compressors, small engines, oil coolers, water-cooled rolls, condensers, etc.

PROTECT COMPRESSORS

against undercooling and overcooling

Undercooling cuts down compressor capacity . . . often damages cylinders, other parts.

Overcooling increases wear, destroys lubricants, wastes water.

You can avoid these troubles, step up the performance of your compressors, reduce maintenance, save water and lubricants. How? By replacing uncertain manual control of cooling water . . . by *automatic* control with Sarco self-powered temperature regulators.

½" size . . . only about $37

Inexpensive. Simple. Require no outside power source. Packless. Easy to install by any pipefitter.

Write for Bulletin 710B. Sarco Co., Inc. 635 Madison Ave., New York 22, N. Y.

SARCO

Circle 25A on reply card

GET THE MOST OUT OF YOUR COMPRESSED AIR EQUIPMENT . . . SPECIFY

CONRADER UNLOADER VALVES

New Models . . . Smaller . . . More Compact

Positive operation in any position.

Adjustable differentials.

Operating pressures from 4 p.s.i. to 600 p.s.i.

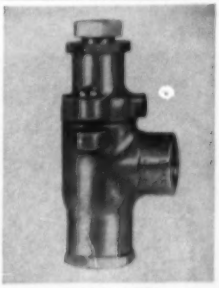
Standard on leading compressors.

Conrader's exchange service trades you a completely rebuilt valve for an old one with new valve guarantee.

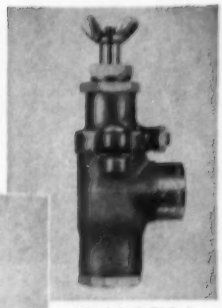
One day service on repairs.

Conrader is equipped to custom design special valves in pressures to 1000 p.s.i.

Distributor Franchises Open.

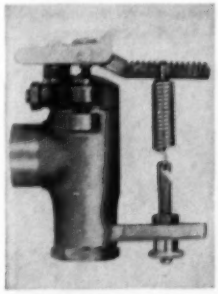


Model RCW

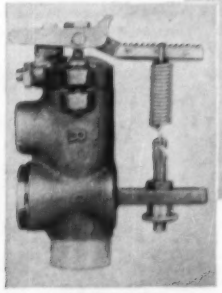


Model RCM-A with hand unloader

Model RCM-A



Model RCF



Model RCS
(Available with drain cock)

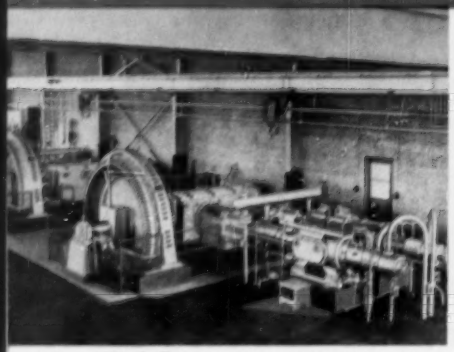
R. CONRADER CO. INC.

Box 924 ERIE, PA. Since 1925

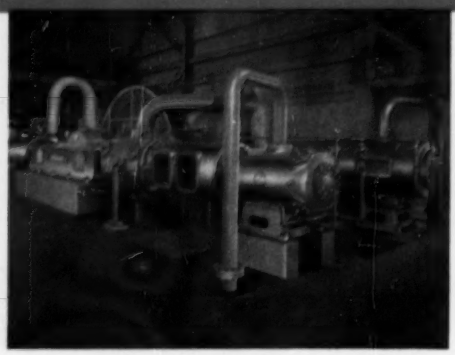
Circle 24A on reply card

Circle 26A on reply card

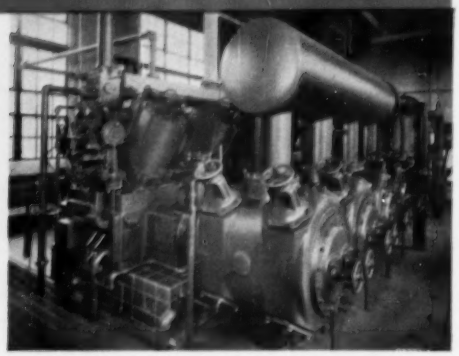
Is your process compressor



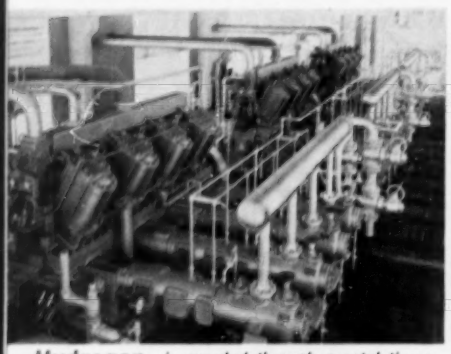
Ultra-High Pressures ...The electric-driven unit shown compresses synthesis gases to 15,000 psi. I-R has built units for 22,000 and 35,000 psi.



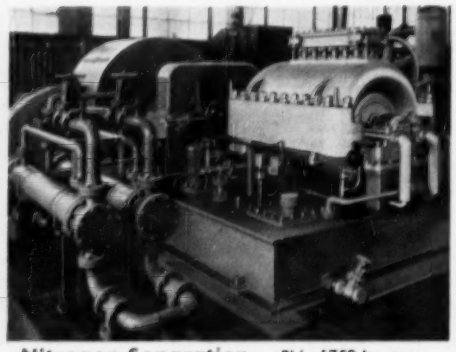
Hydrocarbon Gases are compressed in a chemical plant by six steam-driven XPV compressors totalling 4408 hp.



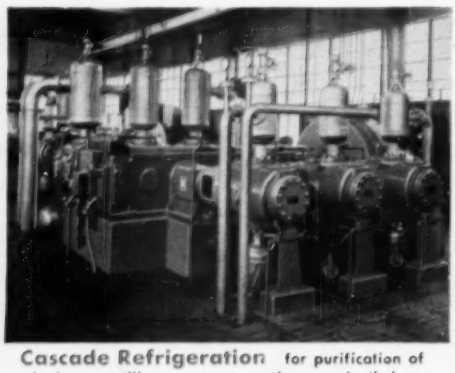
Coke Oven Gas mixed with natural gas is handled and utilized as fuel by these 440-hp SVG gas-engine compressors.



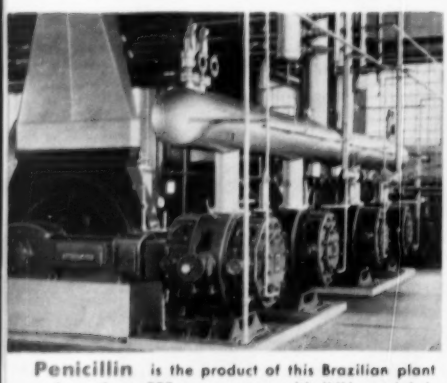
Hydrogen is recycled through a catalytic reformer by these SVG gas-engine compressors equipped with 'NL' non-lubricated cylinders.



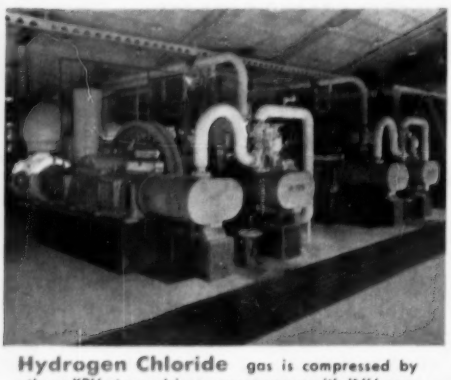
Nitrogen Separation ...This 1750-hp centrifugal unit compresses air for liquefaction and separation in an ammonia synthesis plant.



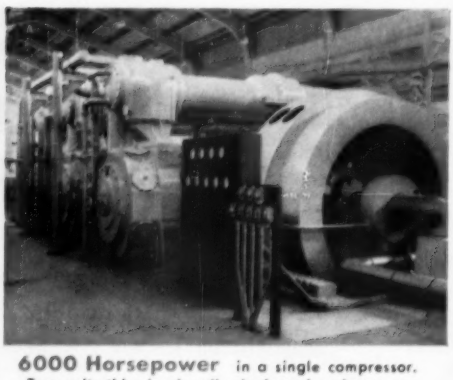
Cascade Refrigeration for purification of hydrogen utilizes propane, methane and ethylene gases compressed separately by these multi-purpose compressors.



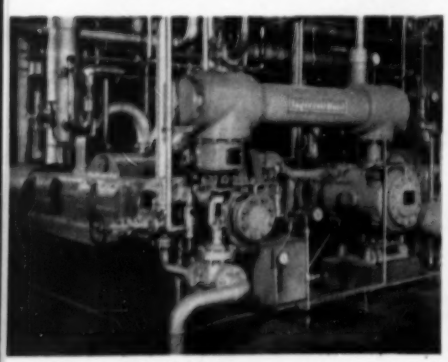
Penicillin is the product of this Brazilian plant where these PRE compressors with 'NL' non-lubricated cylinders supply clean air for agitation.



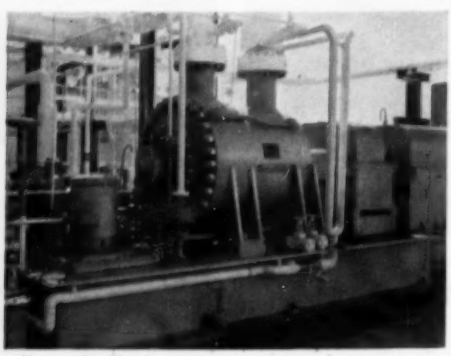
Hydrogen Chloride gas is compressed by three XPV steam-driven compressors with 'NL' non-lubricated cylinders. Intake is at 54° below zero.



6000 Horsepower in a single compressor. Two units this size handle dual services in an ammonia plant. Three smaller I-R units operate in the same plant.



Carbon Dioxide is compressed in a dry-ice plant by two steam-driven XPV compressors. Power and compression cylinders are mounted on the same frame.



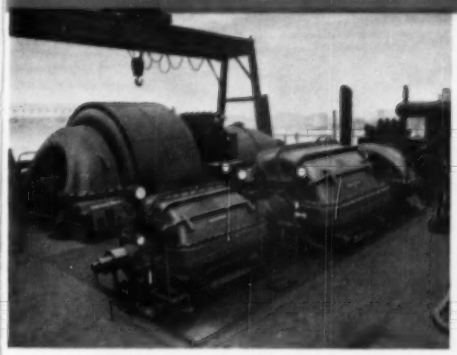
Recycle Hydrogen is handled by this 3500-hp high-pressure centrifugal compressor. The vertically split unit has a forged-steel barrel.

The 21 installations shown here represent only a few of hundreds of processes being served by Ingersoll-Rand reciprocating and centrifugal compressors.

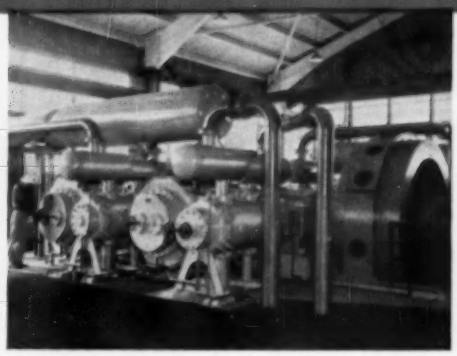
If your compression job is not portrayed here, chances are that I-R engineers have designed compressors now

Send for your copy of Form 3132-A

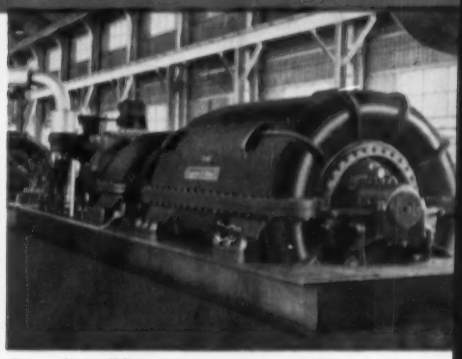
application shown here?



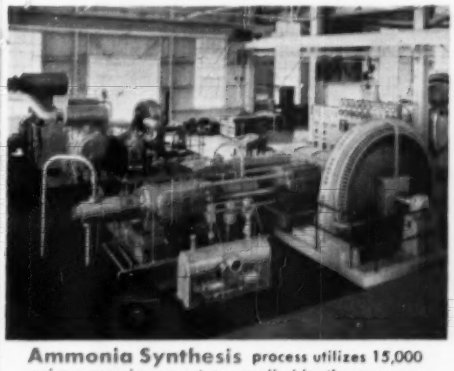
Cat Cracker gas compressor, foreground, is largest in existence, delivering 20,805 cfm at 205 psi. Background unit is main air blower.



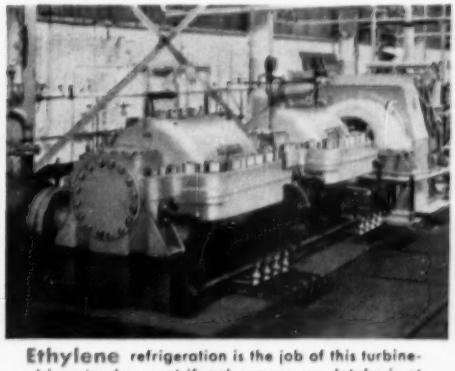
Three Gases are handled separately by this 4000-hp electric-driven HHE compressor. Air, nitrogen and natural gas are compressed simultaneously.



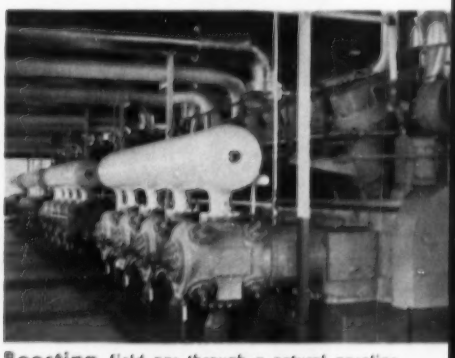
Gasoline Plant ...Each of four centrifugal gas compressors, rated at 38,600 cfm, is driven by an I-R steam turbine.



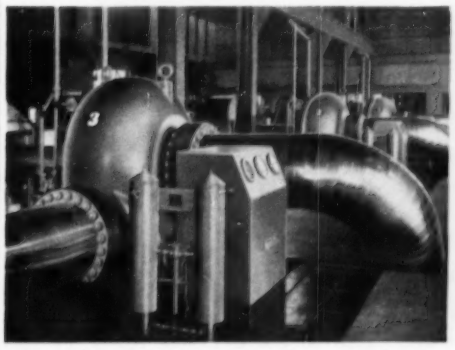
Ammonia Synthesis process utilizes 15,000 psi pressure in converters supplied by the gas compressor in foreground.



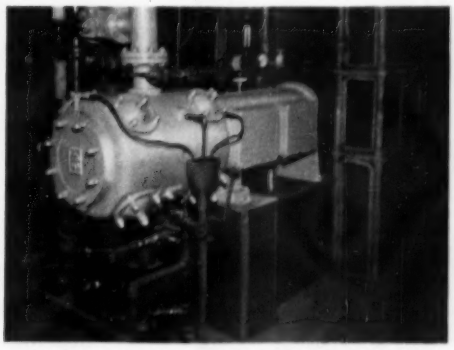
Ethylene refrigeration is the job of this turbine-driven tandem centrifugal compressor. Intake is at 150 degrees below zero.



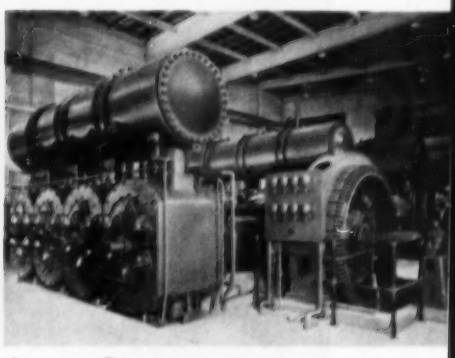
Boosting field gas through a natural gasoline plant into a pipeline is performed by seven 2000-hp gas-engine compressors.



Pipeline station utilizes I-R centrifugal compressors driven by gas turbines to speed natural gas on to marketing areas.



Chlorine Gas is handled safely in a chemical plant by compressors equipped with 'NL' non-lubricated cylinders. Special distance pieces eliminate leakage and corrosion.



Vacuum Pump exhausts air from testing chamber to simulate high-altitude conditions. Piston displacement of this unit is 51,508 cfm.

doing a job similar to yours. The experience they have gained on many other kinds of installation will be a big asset in designing the best compressor for your job. Nowhere else can you get the help of such diversified experience in compressor design.

Your Ingersoll-Rand representative can help you in working out your compression problems.

Over 1000 types and sizes of compressors

Reciprocating	Centrifugal
¼ to 6000 horsepower	Capacities to 255,000 cfm
pressures to 35,000 psi	pressures to 2000 psi

Electric, steam, gas, diesel drives

Ingersoll-Rand

14-678 11 BROADWAY, NEW YORK 4, N.Y.

2000 psi gas for repressuring is furnished by this train of turbo-compressors totalling 60,000 hp. Units are mounted on a pile-supported platform on a lake.

how to get the most out of HOLLOW DRILL STEEL

The present trend in mining is toward smaller drill holes which require the use of smaller bits and, consequently, smaller hollow drill rod sizes. And that's increased the use of *alloy* steels such as Crucible CA DOUBLE DIAMOND and 4E Hollow Drill Rods.

These new alloy rods have proved themselves on many jobs by lengthening rod life, cutting drilling costs. But they are not unmixed blessings, for they will give a good account of themselves only if they are handled properly. Hammer and tongs blacksmithing isn't enough. Alloy rods demand greater care in forging, upsetting and heat-treating.

Should You Use Carbon or Alloy Rods?

There's no one answer to that question, unless it is *use the rod that best fits the individual job.* Generally, air-feed jackhammers and other small, light drills benefit from the use of alloy drill rods. For alloy rods have greater resistance to fatigue, higher elastic limits – important where smaller rod sizes are used.

Rod Stiffness . . .

Rigidity or stiffness can only be increased by enlarging the cross section of the rod. If you decrease the cross section you'll get more whipping no matter what type steel you use, or how you heat treat it. Therefore, don't use a ⅞" hexagon alloy rod when you've been using a 1¼" round carbon rod, unless an increase in flexing and less stiffness is unimportant.

Abrasion Resistance . . .

The higher the hardness the better a drill rod will stand abrasive wear. Alloy rods have the advantage in this respect, for they can be heat-treated to higher hardnesses than can carbon rods.

Notch Effect . . .

Notch effects caused by failure to overlap heats in treating shanks, or those caused by careless handling, chain marks or corrosion pits all cause rod failure. Alloy rods are more resistant to these nicks or notches than carbon steels, but when they do occur failure can be more rapid.

The answer to better drilling is simply this: choose the right drill rod, and then give it reasonable and proper care.

And for the *right* carbon or alloy hollow drill rods – in the sizes, shapes, and grades you need – Crucible is the place to go. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

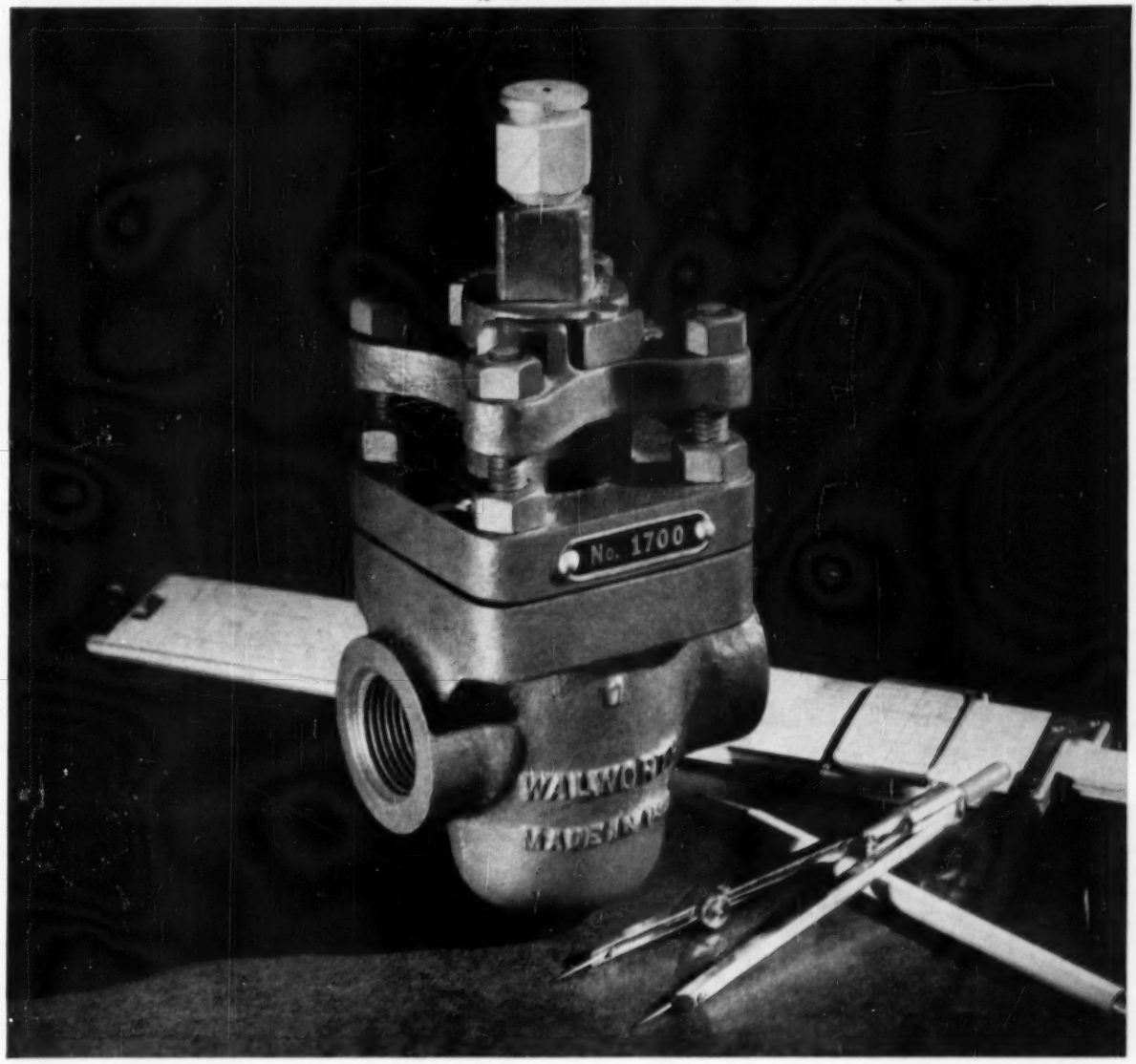
Visit us at Booth 201
American Mining Congress
Metal Mining Show—Oct. 1-4

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Circle 28A on reply card

Illustrated here is the Walworth Lubricated Plug Valve No. 1700, available in sizes from ½" to 5" inclusive, suitable for 200 pounds water, oil, or gas working pressure.



problem-solvers for tough jobs

*LPV's by WALWORTH

If you're familiar with the basic advantages of Plug Valves, you know why Walworth Lubricated Plug Valves work so well in really tough spots. You know about their direct port opening . . . their dead tight shut off. Seating and sealing surfaces are fully protected from attack by fluids being handled by insoluble lubricants.

*Lubricated Plug Valves

Remember, you can get Walworth LPV's in all sizes . . . from ½ to 30 inches . . . for pressures up to 5000 psi and for vacuum service . . . in a number of different styles and patterns. For more information about LPV's and for your copy of the new Walworth LPV Circular, see your local Walworth Distributor.

WALWORTH

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. SOUTHWEST FABRICATING & WELDING CO., INC. • M&H VALVE & FITTINGS CO. • WALWORTH COMPANY OF CANADA, LTD.

Circle 29A on reply card

DISTRICT OFFICES

BOSTON, MASS.
354 Washington St.,
Wellesley Hills, Mass.
Phone Wellesley 5-6868

BUFFALO 21, N.Y.
P.O. Box 77
Phone Plaza 5820

CHICAGO 14, ILL.
2701 N. Paulina Street
Phone Eastgate 7-8450

CINCINNATI 12, OHIO
2089 Sherman Ave., Room 53
Phone Jefferson 1-2855

CLEVELAND 14, OHIO
NBC Bldg. 815 Superior Ave., N.E.
Phone Cherry 1-0862

DAVENPORT, IOWA
705 Union Arcade Bldg.
Phone 6-3133

DETROIT 35, MICHIGAN
18228 James Couzens Hwy.
Phone University 2-5917

ERIE, PENNSYLVANIA
12th & Cranberry Streets
Phone 2-6436

GRAND RAPIDS, MICH.
The Jay Company
3251 Lake Michigan Drive, N.W.
Phone Glendale 6-8391

HOUSTON 4, TEXAS
P. O. Box 8188
4101 San Jacinto
Phone JA 3-5701

INDIANAPOLIS 18, IND.
1701 N. Sherman Drive
P. O. Box 7151
Phone Fleetwood 7-1127, 7-1128

KANSAS CITY 10, MISSOURI
1102 E. 47th Street
Phone Valentine 1-0100

LANCASTER, PA.
Clair M. Williamson Associates
P. O. Box 531
139 Nevin Street
Phone Express 4-1546

LOS ANGELES 22, CALIF.
Westco Pump Sales Co.
4621 Sheila Street
Phone Angelus 2-1155

MILWAUKEE 11, WIS.
316 E. Silver Spring Drive
Phone Woodruff 2-7500, 2-7501

MINNEAPOLIS 4, MINN.
The Edey Company
1302 Fifth Ave., South
Phone Federal 3-2813

NEWARK 4, NEW JERSEY
1245 McCarter Highway
Phone Humboldt 2-9233, 2-9234

PHILADELPHIA 40, PA.
124 S. Easton Rd., Glenside, Pa.
Phone Turner 4-4668

PITTSBURGH 12, PA.
516 Federal Street
North Side Deposit Bank Bldg.
Phone Fairfax 1-4486

SAN FRANCISCO 24, CALIF.
Westco Pump Sales Co.
85 Industrial Street
Phone Valencia 6-5104, 6-5107

SEATTLE 16, WASH.
[illegible] S. Emanuels
4015 Prince Street
Phone West 8700

SKANEATELES, N. Y.
P. O. Box 216
Phone 1093

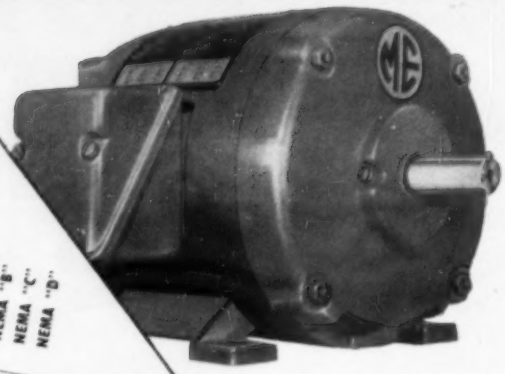
TULSA 3, OKLA.
Bekin Bldg., 20 E. Archer Street
Phone Gibson 7-0520

WAUSAU, WISCONSIN
(Home Office)
Randolph & Cherry Streets
P. O. Box 630
Phone 2-2011 thru 2-2015
EXPORT DEPARTMENT
Marathon Electric Mfg. Corp.
431 Fifth Ave.
New York 16, New York
Phone Murray Hill 5-3322

Call Any Of The Above Offices For Complete Information

MARATHON ELECTRIC
MOTORS — GENERATORS

4 in 1 INTEGRAL HP MOTORS

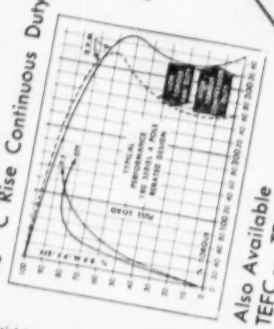


New NEMA Frames 182 thru 326U

MARATHON ELECTRIC

Specifications:
40° C Rise Continuous Duty

Designs:
NEMA "B"
NEMA "C"
NEMA "D"



Also Available
TEFC — TENV — and
Explosion Proof

All ME Explosion Proof Motors Carry Listing in 1972 NEC Handbook for 250 HP Ratings

It's
- ✔ Splash-proof
- ✔ Drip-proof
- ✔ Guarded
- ✔ Weather Protected

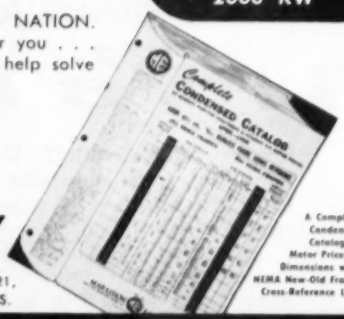
- EXPERIENCE . . . PROVEN PERFORMANCE. There is no substitute for the reliability of proven performance . . . Top Names of the Nation's Industry have proven ME performance in PRODUCING QUALITY PRODUCTS.
- VERSATILITY . . . WIDE RANGE OF DESIGN. Single Phase . . . Polyphase . . . Direct Current NEMA Standard . . . or Special Design ME can design to meet your special specifications.
- SERVICE . . . THROUGHOUT the NATION. There is an ME District Office near you . . . Call our Sales Engineer TODAY to help solve your motor problem.

MOTORS
1/20 HP thru 2500 HP

GENERATORS
1/2 KW thru 2000 KW

Yours for the Asking

WRITE DEPT. 21,
WAUSAU, WIS.



A Complete Condensed Catalog of Motor Prices & Dimensions with NEMA New-Old Frame Cross-Reference List.

SINCE 1913

MARATHON ELECTRIC

HOME OFFICE AND FACTORY, WAUSAU, WIS. FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

SALES OFFICES IN PRINCIPAL CITIES

new...

pre-lubricated take-up bearings

SLASH maintenance costs

Pre-Lubricated At Our Factory For Life • Seals Lubricant In—Dirt Out • Standard Series Ball Bearings • Self-Aligning • Frames of Welded Structural Steel • Can be Operated in Tension or Compression

Woods

T. B. WOOD'S SONS COMPANY

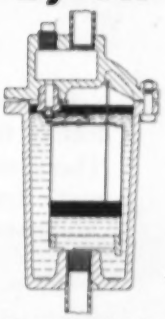
CHAMBERSBURG, PA.

Cambridge, Mass. Newark, N. J. Cleveland, O. Atlanta, Ga. Dallas, Texas

"Our 100th Anniversary"

Circle 31A on reply card

THIS AIR TRAP is not stopped by oil



Inverted Bucket Air Traps.
Side-inlet side-outlet styles available.

NOW you can get dependable, automatic drainage of water from compressed air intercoolers, aftercoolers, receivers and separators even though the compressor is pumping heavy oil. Any oil reaching Armstrong Inverted Bucket Air Traps collects at the top and is discharged ahead of the water.

Armstrong Air Traps have a simple, proven design; there's nothing to stick, bind or clog. Stainless steel mechanism resists corrosion. For pressures to 900 lbs. *Guaranteed to Satisfy.*

ARMSTRONG MACHINE WORKS

8856 Maple Street • Three Rivers Michigan

SEND FOR FREE BULLETIN No. 2022 GIVING DETAILS

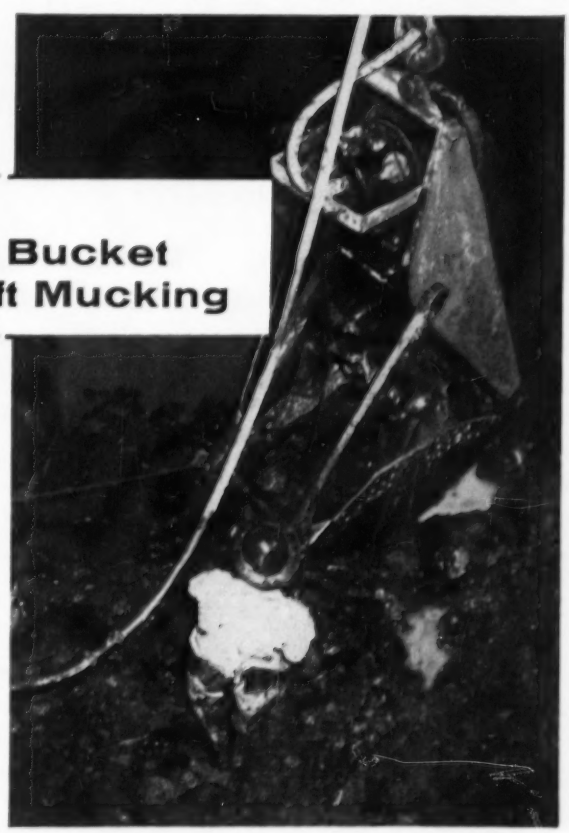
Manufacturers of the well known ARMSTRONG STEAM TRAP

Circle 32A on reply card

"This is the best thing I've found in Air-operated Clamshells"

states James Williamson of Williamson Shaft Contracting Company about

The New Blaw-Knox Air-operated Clamshell Bucket for Excavating and Shaft Mucking



These words come from a man who has been in the shaft contracting business since 1900. He goes on to say, "It loads faster and has much more closing power. I believe that its balance and streamlining make it much safer to operate."

This new Blaw-Knox air-operated clamshell bucket is suspended from a single cable, operates on normally available 85 to 100 pounds air pressure. It is controlled by a chain release connected to the walking beam type closing and opening valve.

The ⅜ cu. yd. size accommodates either the Ingersoll-Rand Model H-U or Gardner-Denver Model HK air hoist. The ½ cu. yd. size accommodates either the Ingersoll-Rand Model H-5-U or Gardner-Denver Model HM air hoist. The hoist you specify can be factory- or field-mounted.

For descriptive bulletins or further information, contact your nearby Blaw-Knox Bucket dealer or the factory.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

Circle 33A on reply card

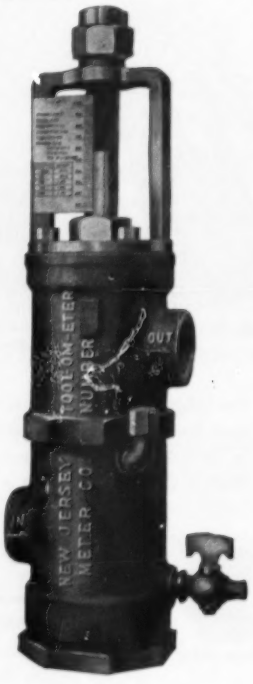
THE TOOL-OM-ETER

Compressed Air Meter shows direct on a scale, in cubic feet of free air per minute, the flow of air in a pipe or hose. These meters will show the air consumption of any pneumatic tool, rock drill, air motor, sand blast, air-lift, or other application of compressed air.

They are also used for maintaining air equipment in most effective working condition. You can get the facts about your use of compressed air, and these facts will enable you to bring your costs and production under profitable control. Write for new Bulletin A-8.

WE SPECIALIZE in compressed air devices, including the "DriAir" Separator for automatically removing the water from compressed air lines. Ask for Bulletin DA.

New Jersey Meter Co.
Plainfield, N. J.



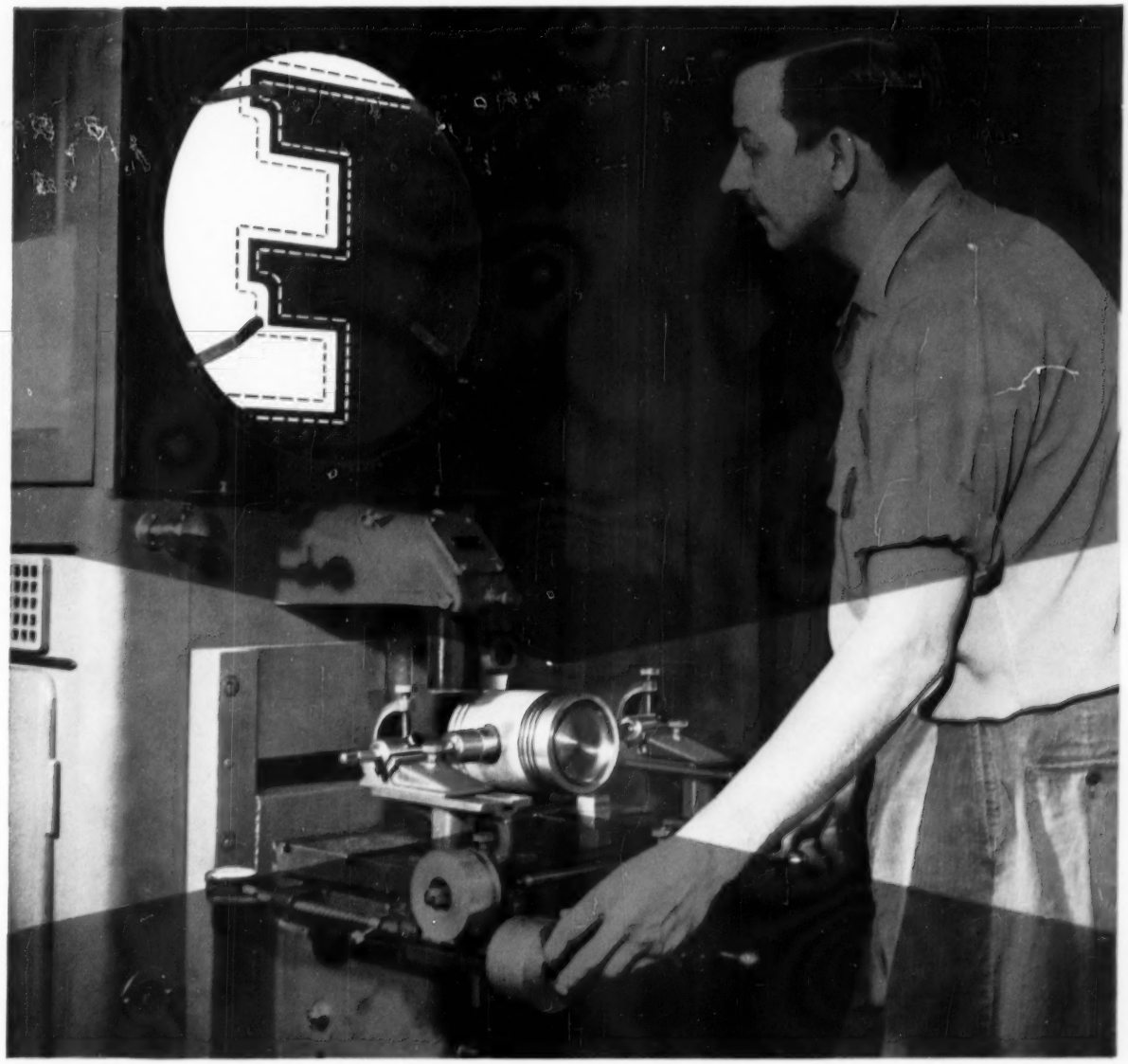
Circle 34A on reply card

ADVERTISERS INDEX

Adams Co., Inc. R. P. 17, 20
American Air Filter Co., Inc. 19
Anaconda Company 26
Armstrong Machine Works 33
Bethlehem Steel Company 15
Blaw-Knox Company 33
Compressed Air Magazine Co. 27
Conrader Co., Inc. R. 27
Continental Motors Corporation 23
Crucible Steel Co. of America 30
Detroit Diesel Division—General Motors ..... 3rd Cover
Dollinger Corporation 3
Eimco Corporation, The 4
Electric Machinery Mfg. Company 13
Garlock Packing Company, The 12
General Electric Company 6, 7
Grinnell Company, Inc. 8
Ingersoll-Rand Company 9, 19, 24, 28, 29
International Nickel Co., The 10
Madison-Kipp Corporation 14
Marathon Electric 32
Maxim Silencer Co., The 18
National Forge & Ordnance Co. 22
Naylor Pipe Company 16
New Jersey Meter Company 34
N.Y. & N.J. Lubricant Co. 20
Niagara Blower Company 21
Sarco Company, Inc. 27
Schrader's Sons, A. 11
SKF Industries, Inc. 25
Texas Company, The ..... 2nd Cover
Timken Roller Bearing Co. ..... Back Cover
Walworth Company 31
Wood's Sons Co., T.B. 33

GM DETROIT DIESEL PARTS

—factory-engineered for long life, low-cost service



SHADOWGRAPH CHECKING is one of the precision tests that assure highest quality of factory-engineered GM Detroit Diesel original and replacement parts. In this photo, a magnified piston ring groove is compared with a perfect standard graph. This precision control is important to piston lubrication.

Scientific packaging of GM Detroit Diesel parts assures protection both in shipment and storage.

You're always money ahead when you buy factory-engineered GM Detroit Diesel parts from your Distributor or Dealer

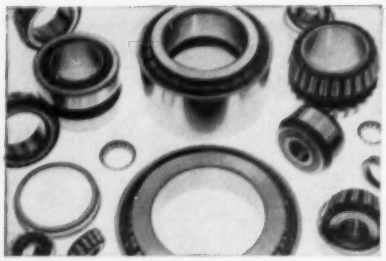
DETROIT DIESEL

Engine Division of General Motors • Detroit 28, Michigan

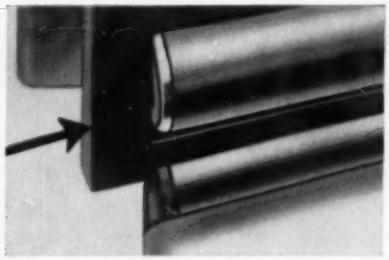
In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario

Circle 35A on reply card.

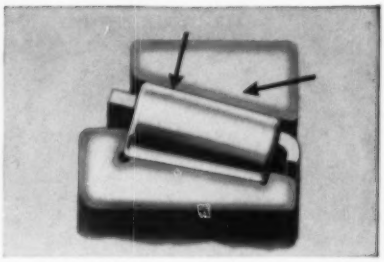
Get all these advantages . . .
specify TIMKEN® tapered roller bearings



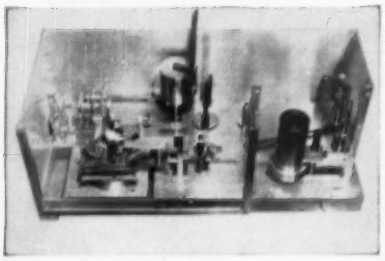
THERE ARE 27 TYPES of Timken® tapered roller bearings. This wide selection means you get the bearing design exactly suited to your job. Whatever your bearing application problem, we can help solve it.



THE SOFT STEEL CAGE used in Timken tapered roller bearings separates the rollers, keeping them spaced evenly. This prevents scuffing of the rollers, adds to the bearing life and gives you more for your money.

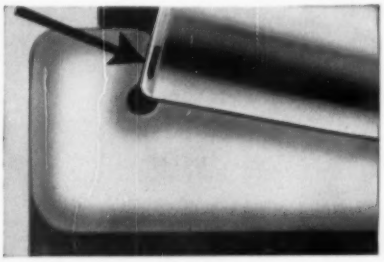


HARD ON THE OUTSIDE, tough on the inside. To take shock loads, give longer life, Timken bearing rollers and races are case-carburized to have a hard, wear-resistant surface over a tough, shock-resistant core.

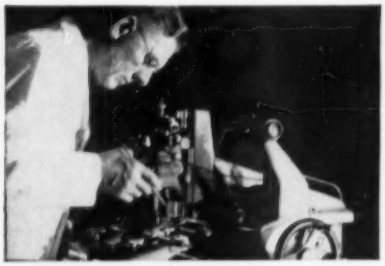


MICRO-INCH FINISH is standard for Timken bearings. This profilograph checks contours and smoothness of circular surfaces to a millionth of an inch, helps us make Timken bearings truer, quieter, longer-wearing.

6,525 SIZES, the world's largest selection of tapered roller bearings. From bearings smaller than your finger to 71½" in inside diameter, the Timken Company can supply the size you need for any specific application.

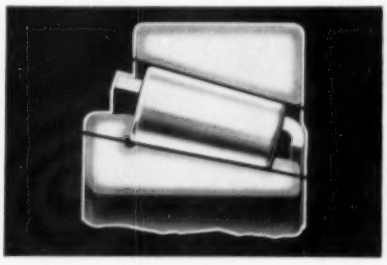


POSITIVE ROLLER ALIGNMENT is assured because the taper in Timken bearings holds ends of rollers snug against the rib. The taper in Timken bearings lets them take radial or thrust loads or any combination.



ACCURATE TO 50 MILLIONTHS of an inch. This Universal Measuring Machine checks gages and machine parts used to make Timken bearings. Our gage laboratory, one of the world's best equipped, helps make Timken tapered roller bearings your No. 1 bearing value.

WE MAKE OUR OWN FINE ALLOY STEEL. No other American bearing maker does. This spectrometer helps control steel quality—in 40 seconds gives the exact chemical analysis of a melt. In a few minutes, results are flashed to the melter. It's another step in rigid quality control.



FULL LINE OF CONTACT between Timken bearings' rollers and races gives them *extra* load-carrying capacity. To get *all* these advantages, specify "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN *TAPERED ROLLER BEARINGS ROLL THE LOAD*

TRADE-MARK REG. U. S. PAT. OFF.

Circle 36A on reply card